STX30, STX38, and STX46 Lawn Tractors

TECHNICAL MANUAL

John Deere
Worldwide Commercial and
Consumer Equipment Division

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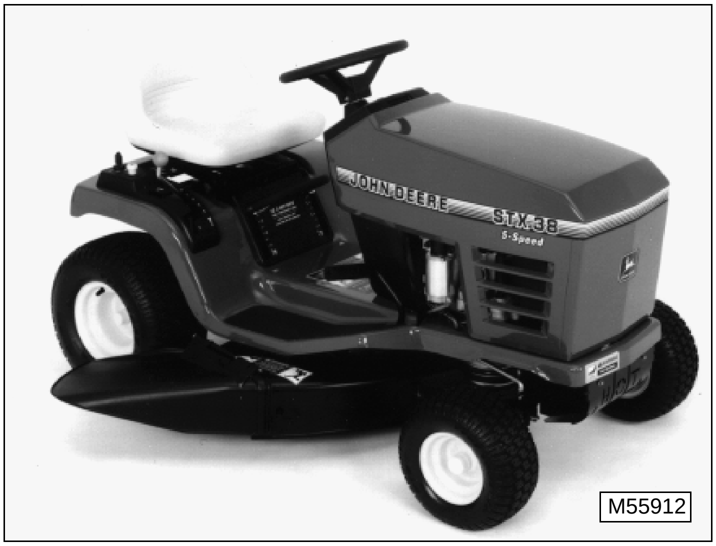
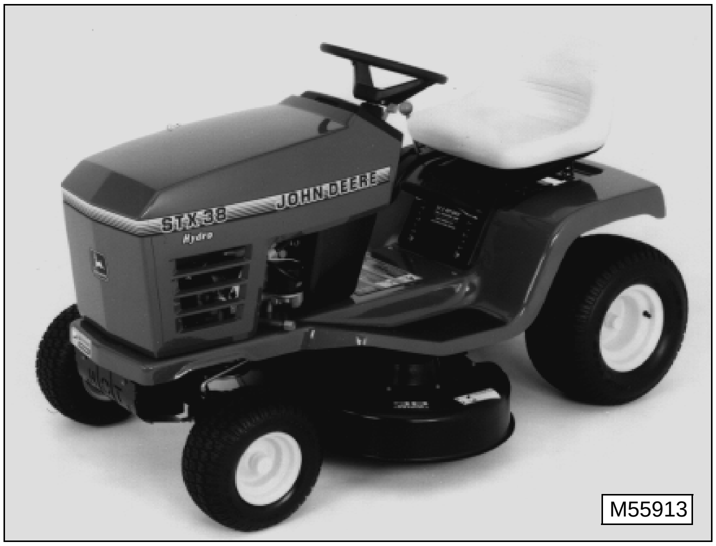
TM1418 (26Oct92)

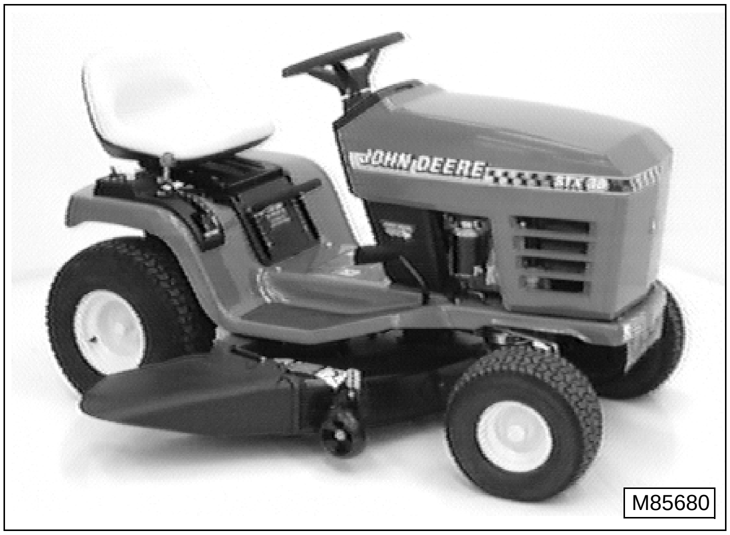
Litho in U.S.A



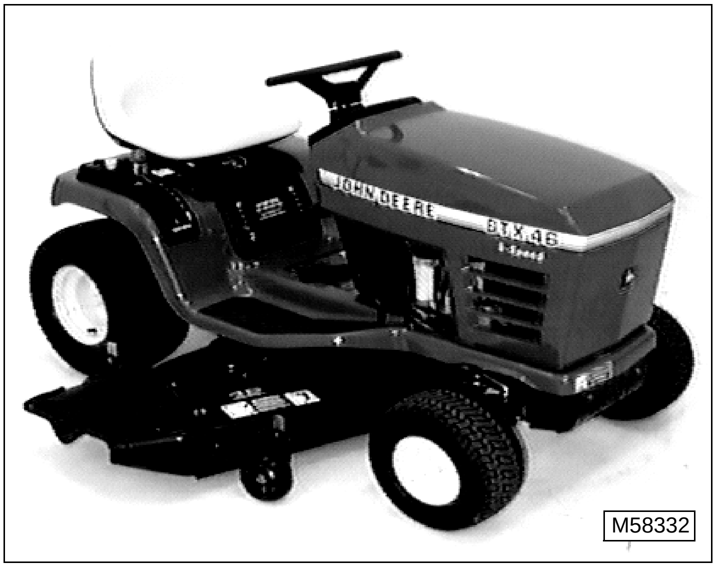
STX38 Gear Drive



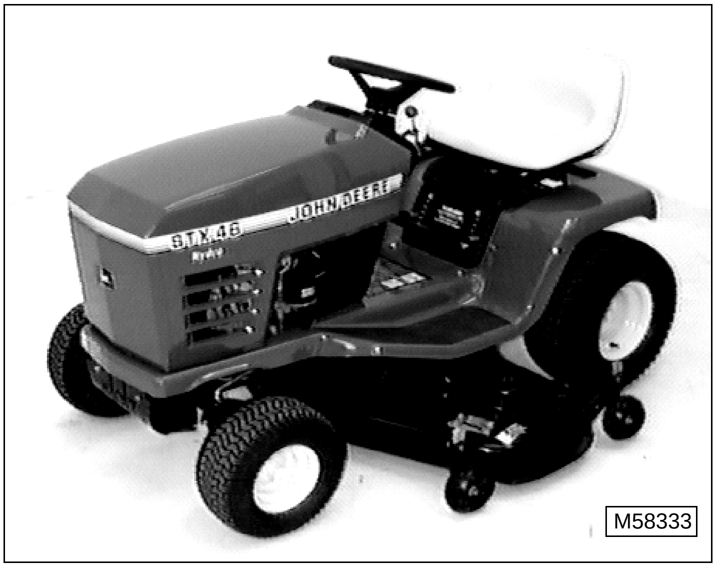
STX38 Hydrostatic Drive



STX38 Motorsport Edition



STX46 Gear Drive



STX46 Hydrostatic Drive

This technical manual is written for an experienced technician and contains sections that are specifically for this product. It is a part of a total product support program.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

- Table of Contents
- Specifications
- Theory of Operation
- Troubleshooting Diagram
- Diagnostics
- Tests & Adjustments
- Repair

Note: Depending on the particular section or system being covered, not all of the above groups may be used.

Each section will be identified with a symbol rather than a number. The groups and pages within a section will be consecutively numbered.

All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

We appreciate your input on this manual. To help, there are postage paid post cards included at the back. If you find any errors or want to comment on the layout of the manual please fill out one of the cards and mail it back to us.

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Safety

Specifications and Information

Engine

Electrical

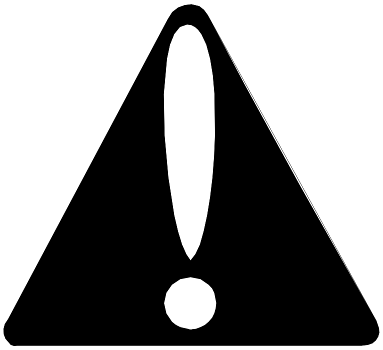
Power Train (Gear)

Power Train (Hydrostatic)

Steering

Miscellaneous

RECOGNIZE SAFETY INFORMATION



This is the safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

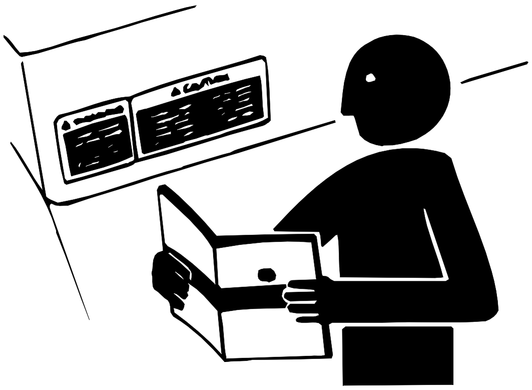
Follow recommended precautions and safe servicing practices.

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

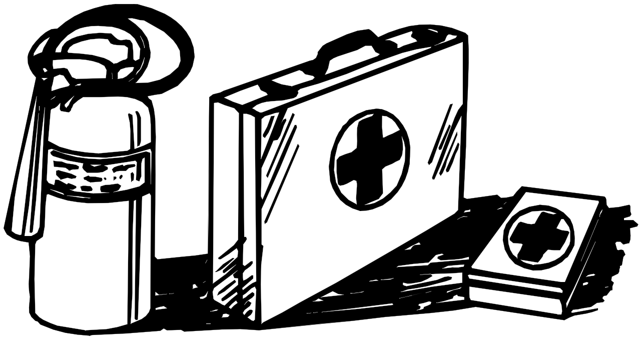
REPLACE SAFETY SIGNS



Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

HANDLE FLUIDS SAFELY-AVOID FIRES

Be Prepared For Emergencies



When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

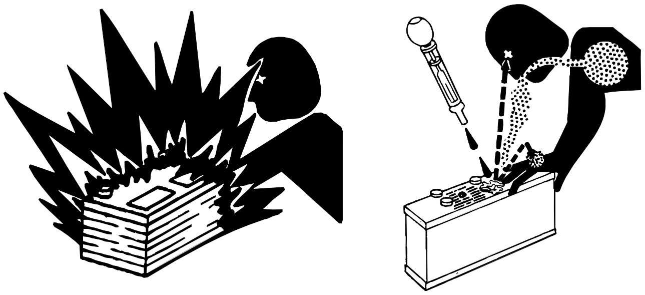
Do not store oily rags; they can ignite and burn spontaneously.

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.

USE CARE IN HANDLING AND SERVICING BATTERIES



Prevent Battery Explosions

- Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.
- Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.
- Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

Prevent Acid Burns

- Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

- **Avoid acid burns by:**

1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

- **If you spill acid on yourself:**

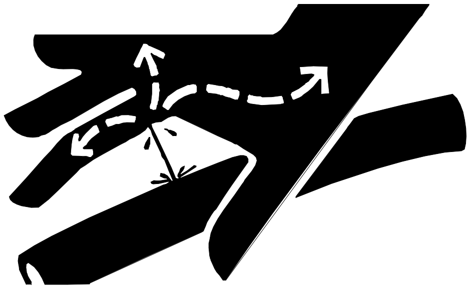
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10_15 minutes.
4. Get medical attention immediately.

- **If acid is swallowed:**

1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

USE CARE AROUND HIGH-PRESSURE FLUID LINES

Avoid High-pressure Fluids



Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid injury from escaping fluid under pressure by stopping the engine and relieving pressure in the system before disconnecting or connecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

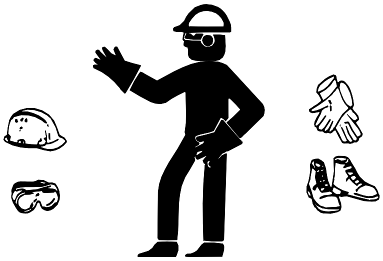
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

USE SAFE SERVICE PROCEDURES

Wear Protective Clothing

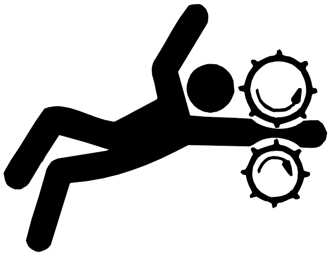


Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

Service Machines Safely



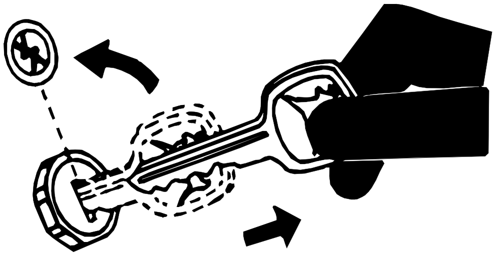
Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards. Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, use the correct size tools. **DO NOT** use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches. Use only service parts meeting John Deere specifications.

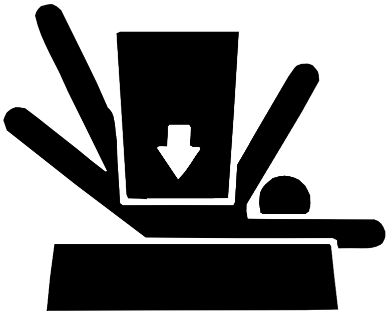
Park Machine Safely



Before working on the machine:

1. Lower all equipment to the ground.
2. Stop the engine and remove the key.
3. Disconnect the battery ground strap.
4. Hang a “DO NOT OPERATE” tag in operator station.

Support Machine Properly And Use Proper Lifting Equipment



If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

Lifting heavy components incorrectly can cause severe injury or machine damage. Follow recommended procedure for removal and installation of components in the manual.

Work In Clean Area

Before starting a job:

1. Clean work area and machine.
2. Make sure you have all necessary tools to do your job.
3. Have the right parts on hand.
4. Read all instructions thoroughly; do not attempt shortcuts.

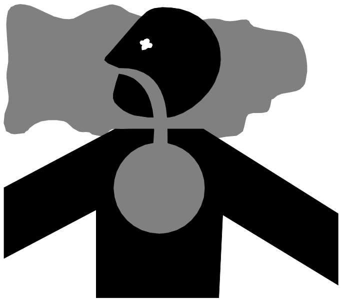
Using High Pressure Washers

Directing pressurized water at electronic/electrical components or connectors, bearings, hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure and spray at a 45 to 90 degree angle.

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

Work In Ventilated Area



Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

WARNING: California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Remove Paint Before Welding Or Heating

Avoid potentially toxic fumes and dust. Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. Do all work outside or in a well ventilated area. Dispose of paint and solvent properly. Remove paint before welding or heating: If you sand or grind paint, avoid breathing the dust. Wear an approved respirator. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos. Keep bystanders away from the area.

SERVICE TIRES SAFELY

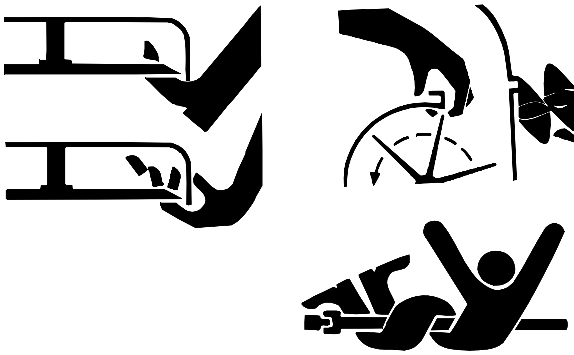
Explosive separation of a tire and rim parts can cause serious injury or death.

Do not attempt to mount a tire unless you have the proper equipment and experience to perform the job. Always maintain the correct tire pressure. Do not inflate the tires above the recommended pressure. Never weld or heat a wheel and tire assembly. The heat can cause an increase in air pressure resulting in a tire explosion. Welding can structurally weaken or deform the wheel.

When inflating tires, use a clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of or over the tire assembly. Use a safety cage if available.

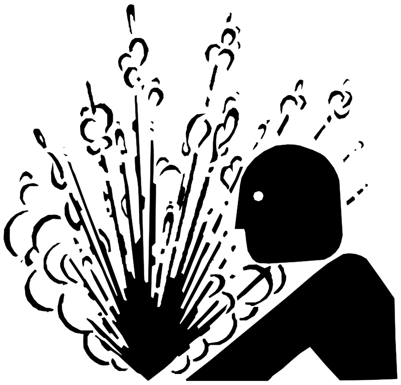
Check wheels for low pressure, cuts, bubbles, damaged rims or missing lug bolts and nuts.

AVOID INJURY FROM ROTATING BLADES, AUGERS AND PTO SHAFTS



Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

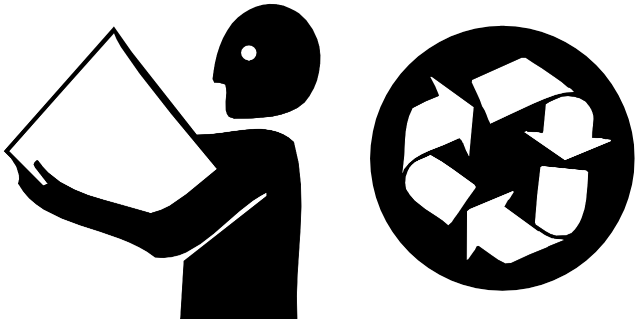
SERVICE COOLING SYSTEM SAFELY



Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off machine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

HANDLE CHEMICAL PRODUCTS SAFELY



Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques. Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

Dispose of Waste Properly

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries. Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them. Do not pour waste onto the ground, down a drain, or into any water source. Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.

LIVE WITH SAFETY

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

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GENERAL VEHICLE SPECIFICATIONS

Engine:

Make	Kohler
Style	Command LT
STX30	CV12.5—1216s
STX38 (Serial No. —270000)	CV12.5—1215
STX38 (Serial No. 210001—270000)	CV12.5—1270
STX38 (Serial No. 270001—595000 & Motorsport)	CV13S—21509
STX46 (Serial No. 210001—270000)	CV14S—1463
STX46 (Serial No. 270001—595000)	CV15S—41521
Type	Gasoline, Air Cooled, Single Cylinder, 4-Cycle, Overhead Valves
Crankcase Oil Capacity (with filter)	1.8 L (1.9 U.S. qt)
Oil Type: (Warm Climate)	10W30
(Cold Climate)	5W30

Electrical:

Charging System	Flywheel/Electronic Magneto
Magneto Air Gap	0.2—0.3 mm (0.008—0.012 in.)
Charging Capacity	15 amp (regulated)
Spark Plug	Champion RC12YC
Spark Plug Air Gap	1.0 mm (0.040 in.)
Battery Type	BCI Group, U1
Battery Reserve Capacity	23 min. at 25 amp
Battery Cold Cranking Amp	25 amp at 27° C (0° F) for 20 minutes
Battery Specific Gravity	Above 1.225 Points
Starter Type	Bendix Inertia Drive
PTO Clutch Type	Electric (Manufactured by Warner)
Fuel Shut-Off Solenoid (Optional)	Replaceable (Below Carburetor Float Bowl)
Headlight Kit (Optional)	Two Bulbs—Each 12 Volt/23W/1.9 Amp Draw

Fuel/Air System:

Carburetor Make	Walbro
Carburetor Type	Side Draft
Throttle/Choke	Unitized Control Linkage
Carburetor Fuel Shut-Off Solenoid (Optional)	Electric
Fuel Delivery	Gravity Flow
Fuel Filter	Replaceable Paper (in-line type)
Fuel Type	Unleaded (87 octane minimum)
Fuel Tank Capacity	4.7 L (1.25 gal)
Air Filter	Paper Element with Foam Pre-cleaner
Muffler Type	Anti-Backfire

Power Train:

Gear Transaxle—

Make	Dana
Model	Spicer Heavy-Duty 4360 Transaxle
Type	Five-Speed/Linear Shift
Domestic Ground Speeds (at FAST idle—3350 rpm) and Gear Ratios:	
1st Gear	(STX30 & STX38 SN —210000 2.2km/hr) 2.4 km/hr (1.5 mph)—61.67:1
2nd Gear	3.2 km/hr (2.0 mph)—46.67:1
3rd Gear	(STX30 & STX38 SN —210000 4.5km/hr) 5.0 km/hr (3.1 mph)—30.00:1
4th Gear	(STX30 & STX38 SN —210000 5.7km/hr) 6.4 km/hr (4.0 mph)—23.48:1
5th Gear	(STX30 & STX38 SN —210000 8.5km/hr) 8.0 km/hr (5.0 mph)—15.71:1
Reverse	(STX30 & STX38 SN —210000 3.3km/hr) 3.7 km/hr (2.3 mph)—40.00:1
Export Ground Speeds (at FAST idle—3000 rpm) and Gear Ratios:	
1st Gear	1.97 km/hr (1.22 mph)—61.67:1
2nd Gear	2.61 km/hr (1.67 mph)—46.67:1
3rd Gear	4.07 km/hr (2.53 mph)—30.00:1
4th Gear	5.18 km/hr (3.22 mph)—23.48:1
5th Gear	7.76 km/hr (4.82 mph)—15.71:1
Reverse	3.04 km/hr (1.89 mph)—40.00:1
Brake Type	Single, External Brake Disc With Dual Friction Pucks

Power Train: (Continued)

Lubrication—Input Shaft Needle Bearings	Unirex® N3 Grease Only
Lubrication—Transaxle	Shell Darina® D Grease Only
Capacity—Transaxle	0.64 kg (1.406 lbs)

Hydro Transaxle—

Make	Kanzaki
Model (STX38—early models)	Tuff Torq® K50 Transaxle
Model (STX38—late models)	Tuff Torq® K55 Transaxle
Model (STX46)	Tuff Torq® K55 Transaxle
Type	Hydrostatic
Domestic Ground Speeds (at FAST idle—3350 rpm):	
Forward	0—9.3 km/hr (0—5.8 mph)
Reverse	0—4.7 km/hr (0—2.9 mph)
Export Ground Speeds (at FAST idle—3000 rpm):	
Forward	0—7.75 km/hr (0—4.82 mph)
Reverse	0—3.80 km/hr (0—2.36 mph)
Brake Type	Single, External Disc Brake With Friction Pucks
Lubrication	John Deere Plus-4 10W30 Engine Oil, Class CD
Reservoir	Internal
Capacity	1.6 L (3.4 pt)

Traction Drive Belt:

Gear—

Actual effective length	2660±8 mm (104.7±0.3 in.)
Theoretical effective length (short)	2631 mm (103.6 in.)
Theoretical effective length (long)	2710 mm (106.7 in.)

Hydro—

Actual effective length	2485±8 mm (97.8±0.3 in.)
Theoretical effective length (short)	2477 mm (97.5 in.)
Theoretical effective length (long)	2530 mm (99.6 in.)

Mower Deck Drive Belt

38-Inch Deck—

Actual effective length	2425±10 mm (95.5±0.4 in.)

46-Inch Deck—

Actual effective length	3492±10 mm (137.5±0.4 in.)

Mower Deck:

38-Inch Mower Deck—

Type	Rotary—Dual Spindles (Non-Serviceable)
Material Type	Stamped 2.5 mm (0.098 in.) Nominal Gauge Steel
Cutting Blade	Two—76 x 5 x 496 mm (3 x 0.2 x 19.5 in.)
Blade Cutting Edge	30±5° Angle
Blade Wing Lift/Height	40±3 mm (1.57±0.12 in.)
Overall Cutting Width	965 mm (38 in.)
Overall Width (w/o discharge chute)	1026 mm (40.4 in.)
Drive Type	Single V-Belt (with spring-tensioned idler)
Spindle Lubrication	None—Sealed Bearings
Lift Type	Manual—Operator's Station
Cutting Settings	Seven: 31.8—89 mm (1.25—3.5 in.)

Mower Deck: (Continued)

46-Inch Mower Deck—

Type	Rotary—Triple Spindles (Non-Serviceable)
Material Type	Stamped 2.5 mm (0.098 in.) Nominal Gauge Steel
Cutting Blade	Three—50.8 x 5 x 407.4 mm (2 x 0.2 x 16 in.)
Blade Cutting Edge	30±5° Angle
Blade Wing Lift/Height	20.3±3 mm (0.8±0.12 in.)
Overall Cutting Width	1168.4 mm (46 in.)
Overall Width (w/o discharge chute)	1308 mm (51.5 in.)
Drive Type	Single V-Belt (with spring-tensioned idler)
Spindle Lubrication	None—Supplier Fill Only
Lift Type	Manual—Operator's Station
Cutting Settings	Seven: 31.75 mm—89 mm (1.25—3.5 in.)

Chassis:

Wheelbase	1135 mm (44.69 in.)
Overall Length	1524 mm (60 in.)
Overall Width (w/o mower deck)	908 mm (35.75 in.)
Height	980 mm (38.6 in.)
Average Overall Weight STX38 (with mower deck/no fuel)	195.05 kg (430 lbs)
Average Overall Weight STX46 (with mower deck/no fuel)	204.12 kg (450 lbs)
Hitch Capacity—	
Export:	
Horizontal Pull Maximum	250 N (56 lbs)
Tongue Weight Maximum	65 N (15 lbs)
Domestic:	
Trailer Load Maximum	136 kg (300 lbs)
Trailer Tongue Weight Maximum	23 kg (50 lbs)

Steering:

Type	Manual—Pinion/Sector
Axle Pivot Hub	Shim Adjustable
Lubrication	DuBois MPG-2® Multipurpose Grease
Lubrication Interval	10 hrs (maximum)
Toe-In	6 mm (0.24 in.) — Non-Adjustable
Turning Radius	584 mm (23 in.)

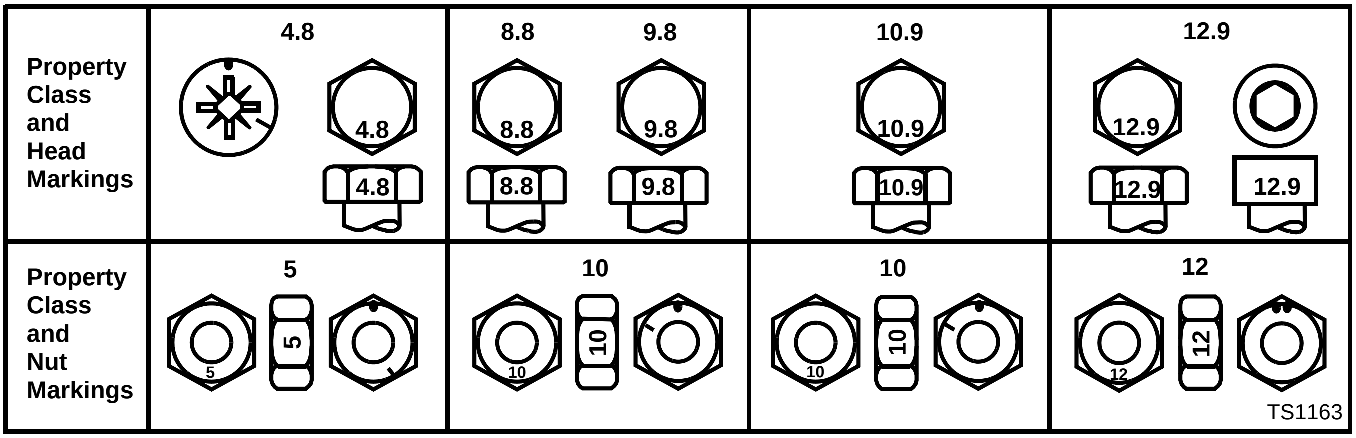
Wheels:

Size—	
Front	6.0 x 4.50
Rear	8.0 x 6.18

Tires:

Size—	
Front (STX30)	13 x 5—6 NHS (2 ply)
Rear (STX30)	18 x 6.50—8 NHS (2 ply)
Front (STX38 SN —210000)	13 x 6.50—6 NHS (2 ply)
Rear (STX38 SN —210000)	18 x 8.50—8 NHS (2 ply)
Front (STX38 SN 210001—270000)	13 x 6.50—6 NHS (2 ply)
Rear (STX38 SN 210001—270000)	18 x 9.50—8 NHS (2 ply)
Front (STX38 SN 270001—595000 & STX46)	15 x 6.50—6 NHS (2 ply)
Rear (STX38 SN 270001—595000 & STX46)	20 x 8.00—8 NHS (2 ply)
Pressure—	
Front (with mower deck)	83 kPa (12 psi)
Front (with snowthrower)	138 kPa (20 psi)
Rear (STX30 with mower deck)	97 kPa (14 psi)
Rear (with mower deck)	55 kPa (8 psi)

METRIC FASTENER TORQUE VALUES



	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
SIZE	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
M6	4.8	3.5	6	4.5	9	6.5	11	8.5	13	9.5	17	12	15	11.5	19	14.5
M8	12	8.5	15	11	22	16	28	20	32	24	40	30	37	28	47	35
M10	23	17	29	21	43	32	55	40	63	47	80	60	75	55	95	70
M12	40	29	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	47	80	60	120	88	150	110	175	130	225	165	205	150	260	109
M16	100	73	125	92	190	140	240	175	275	200	350	225	320	240	400	300
M18	135	100	175	125	260	195	330	250	375	275	475	350	440	325	560	410
M20	190	140	240	180	375	275	475	350	530	400	675	500	625	460	800	580
M22	260	190	330	250	510	375	650	475	725	540	925	675	850	625	1075	800
M24	330	250	425	310	650	475	825	600	925	675	1150	850	1075	800	1350	1000
M27	490	360	625	450	950	700	1200	875	1350	1000	1700	1250	1600	1150	2000	1500
M30	675	490	850	625	1300	950	1650	1200	1850	1350	2300	1700	2150	1600	2700	2000
M33	900	675	1150	850	1750	1300	2200	1650	2500	1850	3150	2350	2900	2150	3700	2750
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2750	4750	3500

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a ±10% variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same class. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the **NUT** instead of the bolt head.

Tighten toothed or serrated-type lock nuts to the full torque value.

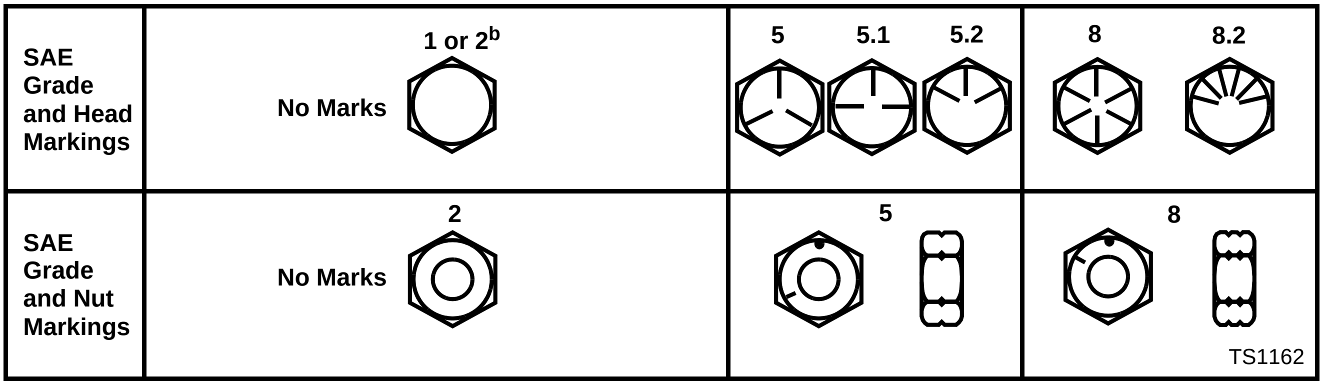
[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.*

Reference: JDS—G200.

METRIC FASTENER TORQUE VALUE - GRADE 7

Size	Steel or Gray Iron Torque		Aluminum Torque	
	N•m	lb-ft	N•m	lb-ft
M6	11	8	8	6
M8	24	18	19	14
M10	52	38	41	30
M12	88	65	70	52
M14	138	102	111	82
M16	224	165	179	132

INCH FASTENER TORQUE VALUES



	Grade 1				Grade 2[b]				Grade 5, 5.1 or 5.2				Grade 8 or 8.2			
	Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]		Lubricated[a]		Dry[a]	
SIZE	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft	N•m	lb-ft
1/4	3.7	2.8	4.7	3.5	6	4.5	7.5	5.5	9.5	7	12	9	13.5	10	17	12.5
5/16	7.7	5.5	10	7	12	9	15	11	20	15	25	18	28	21	35	26
3/8	14	10	17	13	22	16	27	20	35	26	44	33	50	36	63	46
7/16	22	16	28	20	35	26	44	32	55	41	70	52	80	58	100	75
1/2	33	25	42	31	53	39	67	50	85	63	110	80	120	90	150	115
9/16	48	36	60	45	75	56	95	70	125	90	155	115	175	130	225	160
5/8	67	50	85	62	105	78	135	100	170	125	215	160	215	160	300	225
3/4	120	87	150	110	190	140	240	175	300	225	375	280	425	310	550	400
7/8	190	140	240	175	190	140	240	175	490	360	625	450	700	500	875	650
1	290	210	360	270	290	210	360	270	725	540	925	675	1050	750	1300	975
1-1/8	470	300	510	375	470	300	510	375	900	675	1150	850	1450	1075	1850	1350
1-1/4	570	425	725	530	570	425	725	530	1300	950	1650	1200	2050	1500	2600	1950
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2150	1550	2700	2000	3400	2550
1-1/2	1000	725	1250	925	990	725	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a ±10% variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the **NUT** instead of the bolt head.

Tighten toothed or serrated-type lock nuts to the full torque value.

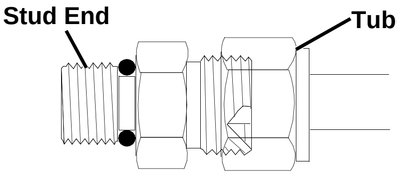
[a] *"Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.*

[b] *"Grade 2" applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. "Grade 1" applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.*

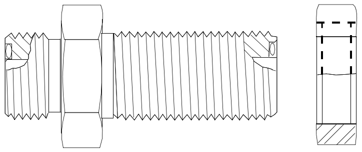
Reference: JDS—G200.

O-RING SEAL SERVICE RECOMMENDATIONS

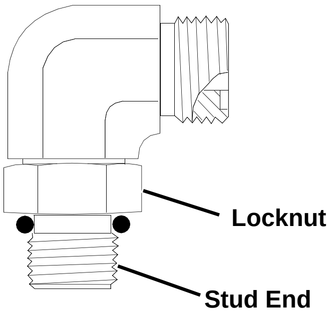
FACE SEAL FITTINGS WITH INCH STUD ENDS TORQUE



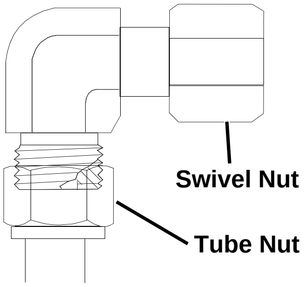
Stud Straight and Tube Nut



Bulkhead Union and Bulkhead Lucknut



90 Adjustable Stud Elbow

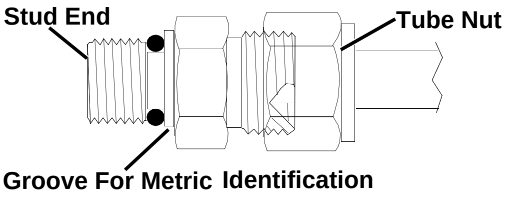


90 Swivel Elbow and Tube Nut

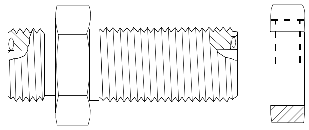
Nominal Tube O.D./Hose I.D.				Face Seal Tube/Hose End					O-ring Stud Ends		
Metric Tube O.D.	Inch Tube O.D.			Thread Size	Tube Nut/ Swivel Nut Torque		Bulkhead Locknut Torque		Thread Size	Straight Fitting or Locknut Torque	
mm	Dash Size	in.	mm	in.	N•m	lb-ft	N•m	lb-ft	in.	N•m	lb-ft
	-3	0.188	4.76						3/8-24	8	6
6	-4	0.250	6.35	9/16-18	16	12	12	9	7/16-20	12	9
8	-5	0.312	7.94						1/2-20	16	12
10	-6	0.375	9.52	11/16-16	24	18	24	18	9/16-18	24	18
12	-8	0.500	12.70	13/16-16	50	37	46	34	3/4-16	46	34
16	-10	0.625	15.88	1-14	69	51	62	46	7/8-14	62	46
	-12	0.750	19.05	1-3/16-12	102	75	102	75	1-1/16-12	102	75
22	-14	0.875	22.22	1-3/16-12	102	75	102	75	1-3/16-12	122	90
25	-16	1.000	25.40	1-7/16-12	142	105	142	105	1-5/16-12	142	105
32	-20	1.25	31.75	1-11/16-12	190	140	190	140	1-5/8-12	190	140
38	-24	1.50	38.10	2-12	217	160	217	160	1-7/8-12	217	160

NOTE: Torque tolerance is + 15 minus 20%.

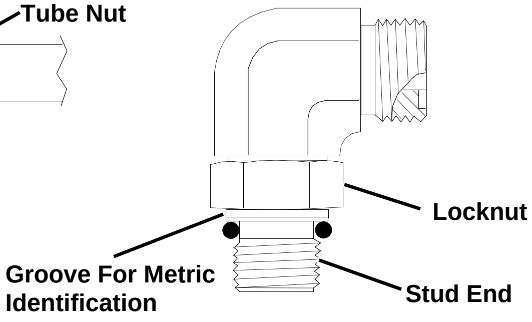
FACE SEAL FITTINGS WITH METRIC STUD ENDS TORQUE



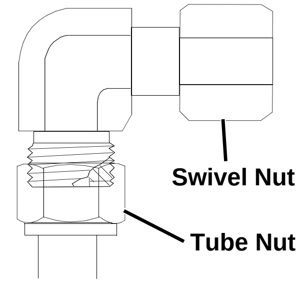
Stud Straight and Tube Nut



Bulkhead Union and Bulkhead Lucknut



90 Adjustable Stud Elbow

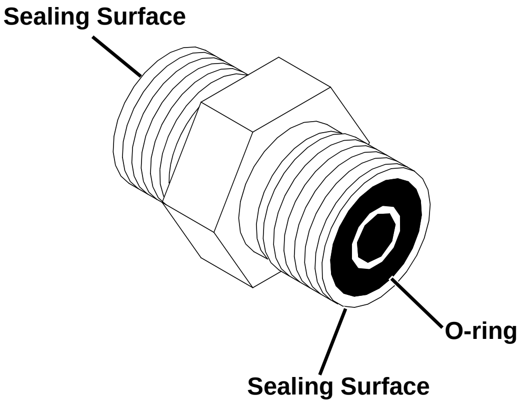


90 Swivel Elbow and Tube Nut

Nominal Tube O.D./Hose I.D.				Face Seal Tube/Hose End						O-ring Stud Ends, Straight Fitting or Locknut					
Metric Tube O.D.	Inch Tube O.D.			Thread Size	Hex Size	Tube Nut/ Swivel Nut Torque		Bulkhead Locknut Torque		Thread Size	Hex Size	Steel or Gray Iron Torque		Aluminum Torque	
mm	Dash Size	in.	mm	in.	mm	N•m	lb-ft	N•m	lb-ft	mm	mm	N•m	lb-ft	N•m	lb-ft
6	-4	0.250	6.35	9/16-18	17	16	12	12	9	M12X1.5	17	21	15.5	9	6.6
8	-5	0.312	7.94												
										M14X1.5	19	33	24	15	11
10	-6	0.375	9.52	11/16-16	22	24	18	24	18	M16X1.5	22	41	30	18	13
12	-8	0.500	12.70	13/16-16	24	50	37	46	34	M18X1.5	24	50	37	21	15
16	-10	0.625	15.88	1-14	30	69	51	62	46	M22X1.5	27	69	51	28	21
	-12	0.750	19.05	1-3/16-12	36	102	75	102	75	M27X2	32	102	75	46	34
22	-14	0.875	22.22	1-3/16-12	36	102	75	102	75	M30X2	36				
25	-16	1.000	25.40	1-7/16-12	41	142	105	142	105	M33X2	41	158	116	71	52
28										M38X2	46	176	130	79	58
32	-20	1.25	31.75	1-11/16-12	50	190	140	190	140	M42X2	50	190	140	85	63
38	-24	1.50	38.10	2-12	60	217	160	217	160	M48X2	55	217	160	98	72

NOTE: Torque tolerance is + 15 minus 20%.

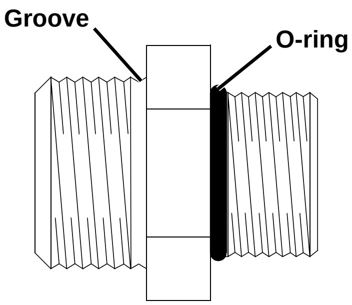
O-RING FACE SEAL FITTINGS



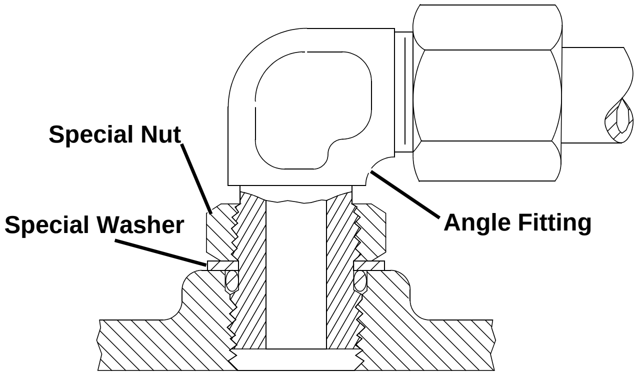
1. Inspect the fitting sealing surfaces. They must be free of dirt or defects.
2. Inspect the O-ring. It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.
4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.
5. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.
6. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting. Do not allow hoses to twist when tightening fittings.

O-RING BOSS FITTINGS

1. Inspect boss O-ring boss seat. It must be free of dirt and defects. If repeated leaks occur, inspect for defects with a magnifying glass. Some raised defects can be removed with a slip stone.



2. Put hydraulic oil or petroleum jelly on the O-ring. Place electrical tape over the threads to protect O-ring from nicks. Slide O-ring over the tape and into the groove of fitting. Remove tape.



3. For angle fittings, loosen special nut and push special washer against threads so O-ring can be installed into the groove of fitting.
4. Turn fitting into the boss by hand until special washer or washer face (straight fitting) contacts boss face and O-ring is squeezed into its seat.
5. To position angle fittings, turn the fitting counter-clockwise a maximum of one turn.
6. Tighten straight fittings to torque value shown on chart. For angle fittings, tighten the special nut to value shown in the chart while holding body of fitting with a wrench.

STRAIGHT FITTING OR SPECIAL NUT TORQUE

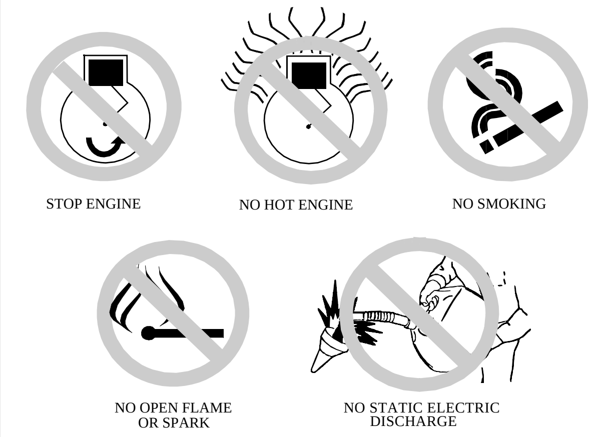
Thread Size	Torque[a]		Number of Flats[b]
	N•m	lb-ft	
3/8-24 UNF	8	(6)	2
7/16-20 UNF	12	(9)	2
1/2-20 UNF	16	(12)	2
9/16-18 UNF	24	(18)	2
3/4-16 UNF	46	(34)	2
7/8-14 UNF	62	(46)	1-1/2
1-1/16-12 UN	102	(75)	1
1-3/16-12 UN	122	(90)	1
1-5/16-12 UN	142	(105)	3/4
1-5/8-12 UN	190	(140)	3/4
1-7/8-12 UN	217	(160)	1/2

[a] Torque tolerance is ± 10 percent.

[b] To be used if a torque wrench cannot be used. After tightening fitting by hand, put a mark on nut or boss; then tighten special nut or straight fitting the number of flats shown.

GASOLINE SPECIFICATIONS
4–CYCLE ENGINES - NORTH AMERICA

⚠ CAUTION



Gasoline is HIGHLY FLAMMABLE, handle it with care.

DO NOT refuel machine while:

- **indoors, always fill gas tank outdoors;**
- **machine is near an open flame or sparks;**
- **engine is running, STOP engine;**
- **engine is hot, allow it to cool sufficiently first;**
- **smoking.**

Help prevent fires:

- **fill gas tank to bottom of filler neck only;**
- **be sure fill cap is tight after fueling;**
- **clean up any gas spills IMMEDIATELY;**
- **keep machine clean and in good repair–free of excess grease, oil, debris, and faulty or damaged parts;**
- **any storage of machines with gas left in tank should be in an area that is well ventilated to prevent possible igniting of fumes by an open flame or spark, this includes any appliance with a pilot light.**

To prevent fire or explosion caused by STATIC ELECTRIC DISCHARGE during fueling:

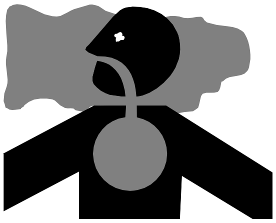
- **ONLY use a clean, approved POLYETHYLENE PLASTIC fuel container and funnel WITHOUT any metal screen or filter.**

To avoid engine damage:

- DO NOT mix oil with gasoline;
- **ONLY use clean, fresh unleaded gasoline with an octane rating (anti-knock index) of 87 or higher**;
- fill gas tank at the end of each day's operation to help prevent condensation from forming inside a partially filled tank;
- keep up with specified service intervals.

Use of alternative oxygenated, gasohol blended, unleaded gasoline is acceptable as long as:

- the ethyl or grain alcohol blends DO NOT exceed 10% by volume or
- methyl tertiary butyl ether (MTBE) blends DO NOT exceed 15% by volume.



IMPORTANT: DO NOT use METHANOL gasolines because METHANOL is harmful to the environment and to your health.

⚠ WARNING

California Proposition 65 Warning: Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

GASOLINE STORAGE

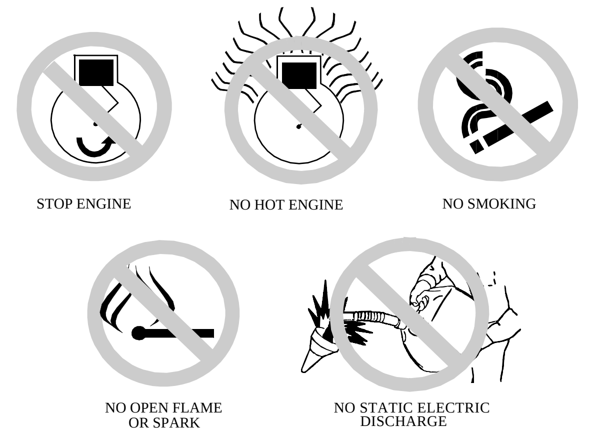
IMPORTANT: Keep all dirt, scale, water or other foreign material out of gasoline.

Keep gasoline stored in a safe, protected area. Storage of gasoline in a clean, properly marked **("UNLEADED GASOLINE") POLYETHYLENE PLASTIC container WITHOUT** any metal screen or filter is recommended. **DO NOT** use de-icers to attempt to remove water from gasoline or depend on fuel filters to remove water from gasoline. Use a water separator installed in the storage tank outlet. **BE SURE** to properly discard unstable or contaminated gasoline. When storing unit or gasoline, it is recommended that you add **John Deere Gasoline Conditioner and Stabilizer (TY15977)** or an equivalent to the gasoline. **BE SURE** to follow directions on container and to properly discard empty container.

4–CYCLE ENGINES - EUROPE

⚠ CAUTION

Gasoline is HIGHLY FLAMMABLE, handle it with care.



DO NOT refuel machine while:

- **indoors, always fill gas tank outdoors;**
- **machine is near an open flame or sparks;**
- **engine is running, STOP engine;**
- **engine is hot, allow it to cool sufficiently first;**
- **smoking.**

Help prevent fires:

- **fill gas tank to bottom of filler neck only;**
- **be sure fill cap is tight after fueling;**
- **clean up any gas spills IMMEDIATELY;**
- **keep machine clean and in good repair–free of excess parts;**
- **any storage of machines with gas left in tank should be in an area that is well ventilated to prevent possible igniting of fumes by an open flame or spark, this includes any appliance with a pilot light.**

To prevent fire or explosion caused by STATIC ELECTRIC DISCHARGE during fueling:

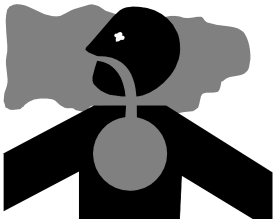
- **ONLY use a clean, approved POLYETHYLENE PLASTIC fuel container and funnel WITHOUT any metal screen or filter.**

To avoid engine damage:

- DO NOT mix oil with gasoline;
- **ONLY use clean, fresh unleaded gasoline with an octane rating (anti-knock index) of 87 or higher**;
- fill gas tank at the end of each day's operation to help prevent condensation from forming inside a partially filled tank;
- keep up with specified service intervals.

Use of alternative oxygenated, gasohol blended, unleaded gasoline is acceptable as long as:

- the ethyl or grain alcohol blends DO NOT exceed 10% by volume or
- methyl tertiary butyl ether (MTBE) blends DO NOT exceed 15% by volume.



IMPORTANT: DO NOT use METHANOL gasolines because METHANOL is harmful to the environment and to your health.

GASOLINE STORAGE

IMPORTANT: Keep all dirt, scale, water or other foreign material out of gasoline.

Keep gasoline stored in a safe, protected area. Storage of gasoline in a clean, properly marked **("UNLEADED GASOLINE") POLYETHYLENE PLASTIC container WITHOUT** any metal screen or filter is recommended. **DO NOT** use de-icers to attempt to remove water from gasoline or depend on fuel filters to remove water from gasoline. Use a water separator installed in the storage tank outlet. **BE SURE** to properly discard unstable or contaminated gasoline. When storing unit or gasoline, it is recommended that you add **John Deere Gasoline Conditioner and Stabilizer (TY15977)** or an equivalent to the gasoline. **BE SURE** to follow directions on container and to properly discard empty container.

4–CYCLE GASOLINE ENGINE OIL

4–CYCLE GASOLINE ENGINE OIL - NORTH AMERICA

IMPORTANT: Kohler command engines were designed and built to use multi-viscosity oil. Multi-viscosity oil is required for proper operation of hydraulic valve lifters used in Kohler command engines.

Use the appropriate oil viscosity based on the expected air temperature range during the period between recommended oil changes. Operating outside of these recommended oil air temperature ranges may cause premature engine failure.

The following John Deere oils are **PREFERRED**:

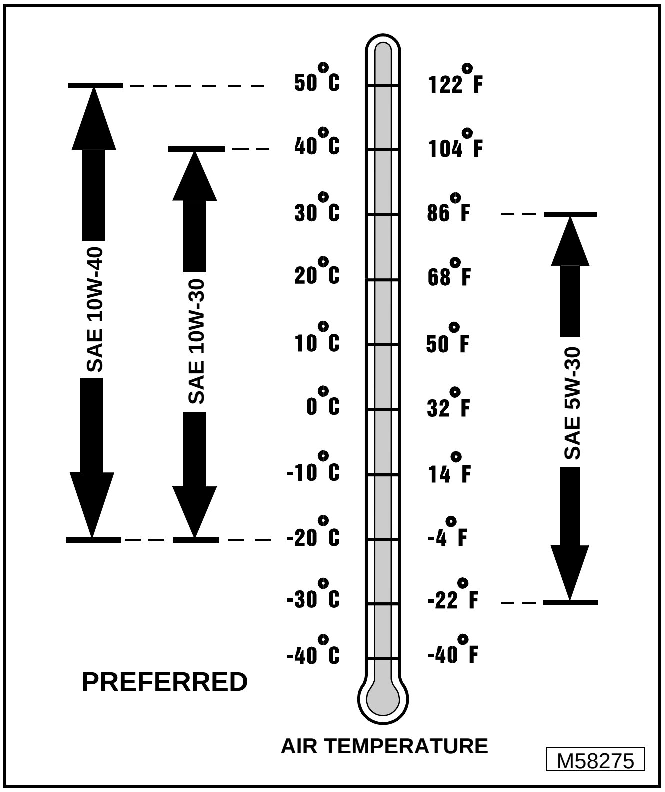
- **PLUS–4®—SAE 10W-40;**
- **TURF–GARD®—SAE 10W-30;**
- **PLUS–4®—SAE 10W-30**;

The following John Deere oil is **also recommended**, based on their specified temperature range:

- **TORQ–GARD SUPREME®—SAE 5W-30**.

Other oils may be used if above John Deere oils are not available, provided they meet one of the following specifications:

- SAE 10W-40—API Service Classification SG or higher;
- SAE 10W-30—API Service Classification SG or higher;
- SAE 5W-30—API Service Classification SG or higher.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL2 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

4–CYCLE GASOLINE ENGINE OIL - EUROPE

IMPORTANT: Kohler command engines were designed and built to use multi-viscosity oil. Multi-viscosity oil is required for proper operation of hydraulic valve lifters used in Kohler command engines.

Use the appropriate oil viscosity based on the expected air temperature range during the period between recommended oil changes. Operating outside of these recommended oil air temperature ranges may cause premature engine failure.

The following John Deere oils are **PREFERRED**:

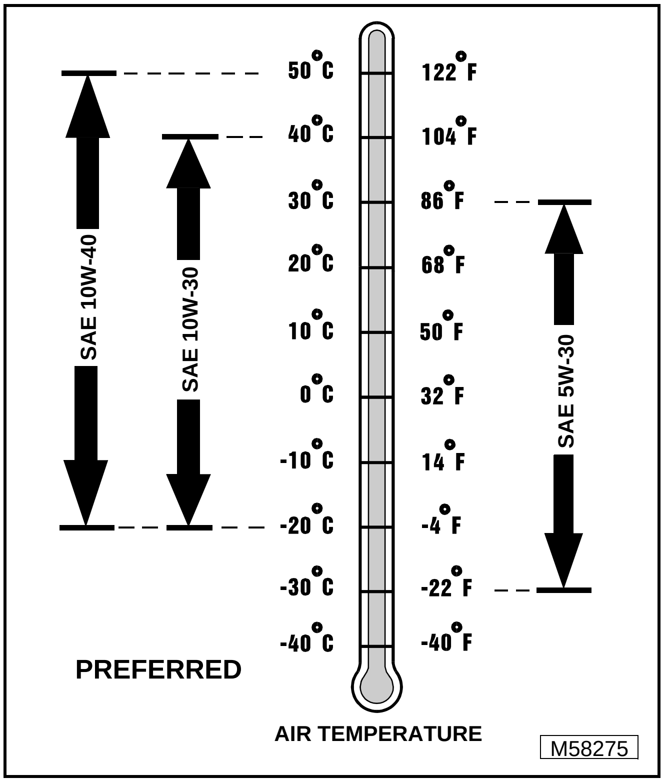
- **TORQ–GARD SUPREME®—SAE 10W-40;**
- **UNI–GARD™—SAE 10W-40;**
- **TORQ–GARD SUPREME®—SAE 10W-30;**
- **UNI–GARD™—SAE 10W-30.**

The following John Deere oil is **also recommended**, based on their specified temperature range:

- **TORQ–GARD SUPREME®—SAE 5W-30;**
- **UNI–GARD™—SAE 5W-30.**

Other oils may be used if above John Deere oils are not available, provided they meet one of the following specifications:

- CCMC Specification G4 or higher.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL2 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide.

BREAK–IN 4-CYCLE GASOLINE ENGINE OIL - NORTH AMERICA

IMPORTANT: ONLY use a quality break-in oil (multi-viscosity) in rebuilt or remanufactured engines for the first 5 hours (maximum) of operation. DO NOT use oils with heavier viscosity weights than SAE 5W-30 or oils meeting specifications API SG or SH, these oils will not allow rebuilt or remanufactured engines to break-in properly.

The following John Deere oil is **PREFERRED**:

- **BREAK–IN ENGINE OIL**.

John Deere BREAK–IN ENGINE OIL is formulated with special additives for aluminum and cast iron type engines to allow the power cylinder components (pistons, rings, and liners as well) to “wear-in” while protecting other engine components, valve train and gears, from abnormal wear. Engine rebuild instructions should be followed closely to determine if special requirements are necessary.

John Deere BREAK–IN ENGINE OIL is also recommended for non-John Deere engines, both aluminum and cast iron types.

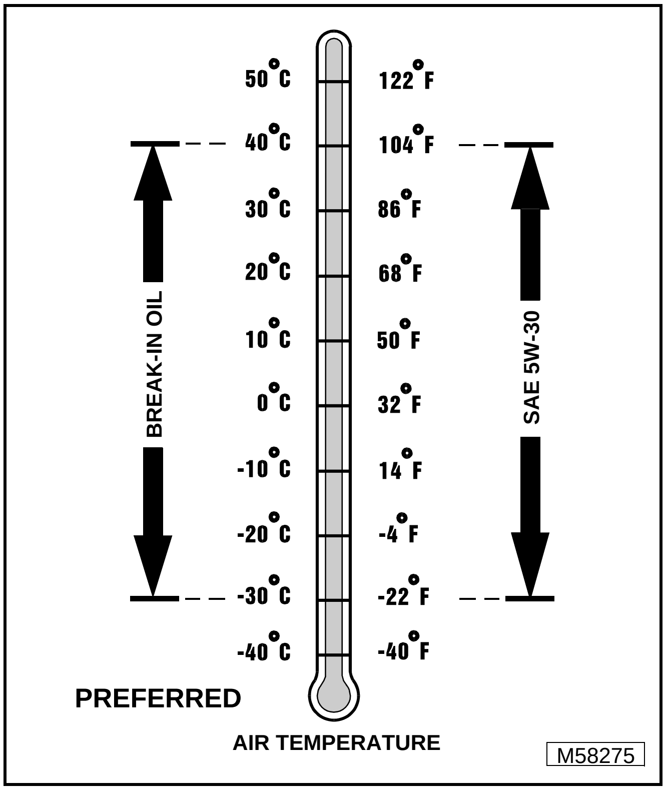
The following John Deere oil is **also recommended** as a break-in engine oil:

- **TORQ–GARD SUPREME®—SAE 5W-30.**

If the above recommended John Deere oils are not available, use a break-in engine oil meeting the following specification during the first 5 hours (maximum) of operation:

- SAE 5W-30—API Service Classification SE or higher.

IMPORTANT: After the break-in period, use the John Deere oil that is recommended for this engine.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL4 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

BREAK–IN 4-CYCLE GASOLINE ENGINE OIL - EUROPE

IMPORTANT: ONLY use a quality break-in oil (multi-viscosity) in rebuilt or remanufactured engines for the first 5 hours (maximum) of operation. DO NOT use oils with heavier viscosity weights than SAE 5W-30 or oils meeting CCMC Specification G5—these oils will not allow rebuilt or remanufactured engines to break-in properly.

The following John Deere oil is **PREFERRED**:

- **BREAK–IN ENGINE OIL**.

John Deere **BREAK–IN ENGINE OIL** is formulated with special additives for aluminum and cast iron type engines to allow the power cylinder components (pistons, rings, and liners as well) to “wear-in” while protecting other engine components, valve train and gears, from abnormal wear. Engine rebuild instructions should be followed closely to determine if special requirements are necessary.

John Deere **BREAK–IN ENGINE OIL** is also recommended for non-John Deere engines, both aluminum and cast iron types.

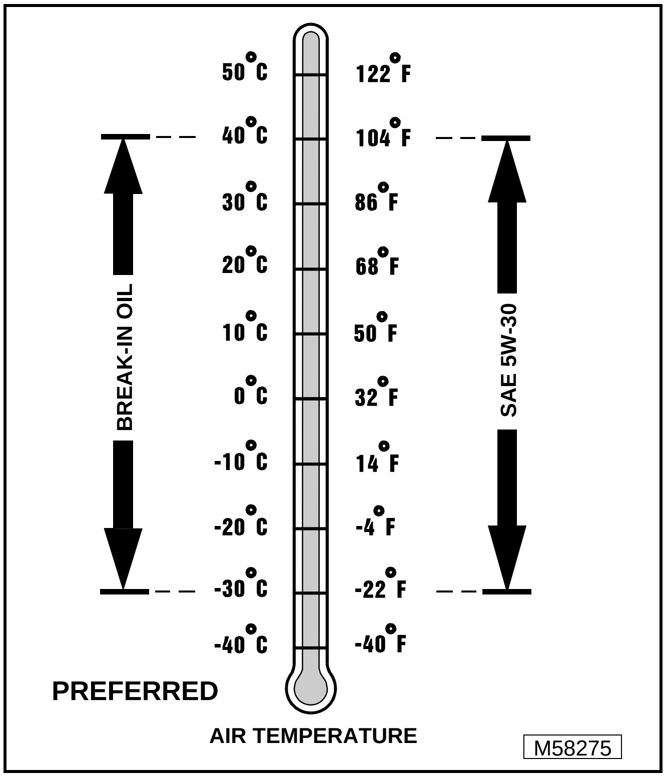
The following John Deere oil is **also recommended** as a break-in engine oil:

- **TORQ–GARD SUPREME®—SAE 5W-30.**

If the above recommended John Deere oils are not available, use a break-in engine oil meeting the following specification during the first 5 hours (maximum) of operation:

- SAE 5W-30—CCMC Specification G4 or higher.

IMPORTANT: After the break-in period, use the John Deere oil that is specified for this engine.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL4 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide.

HYDROSTATIC TRANSMISSION OIL

HYDROSTATIC TRANSMISSION OIL - NORTH AMERICA

Use the following oil viscosity based on the air temperature range. Operating outside of the recommended oil air temperature range may cause premature hydrostatic transmission failure.

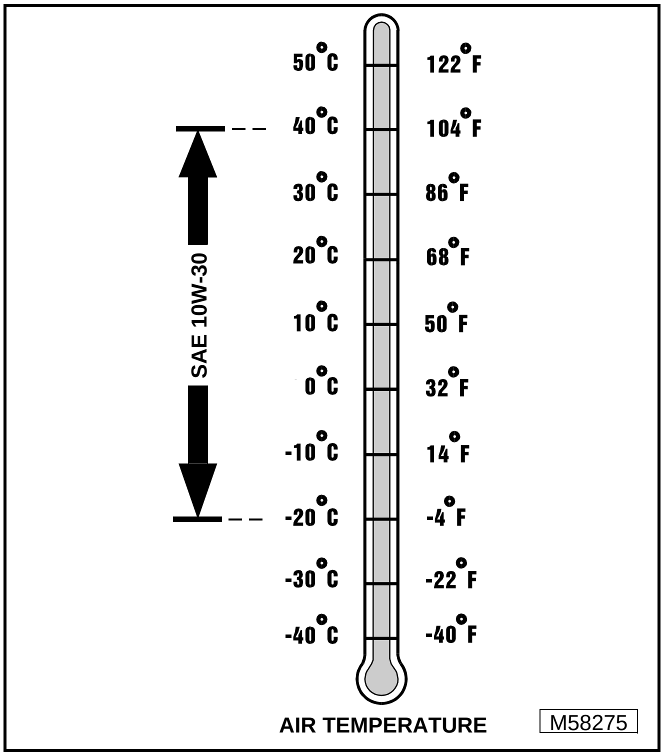
IMPORTANT: ONLY use a quality SAE 10W-30 engine oil in this transmission. DO NOT mix any other oils in this transmission. DO NOT use BIO–HY–GARD® in this transmission.

The following John Deere oils are **PREFERRED**:

- **TURF-GARD®—SAE 10W-30;**
- **PLUS-4®—SAE 10W-30.**

Other oils may be used if above recommended John Deere oils are not available, provided they meet one of the following specifications:

- API Service Classification SG or higher.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL2 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

HYDROSTATIC TRANSMISSION OIL - EUROPE

Use the following oil viscosity based on the air temperature range. Operating outside of the recommended oil air temperature range may cause premature hydrostatic transmission failure.

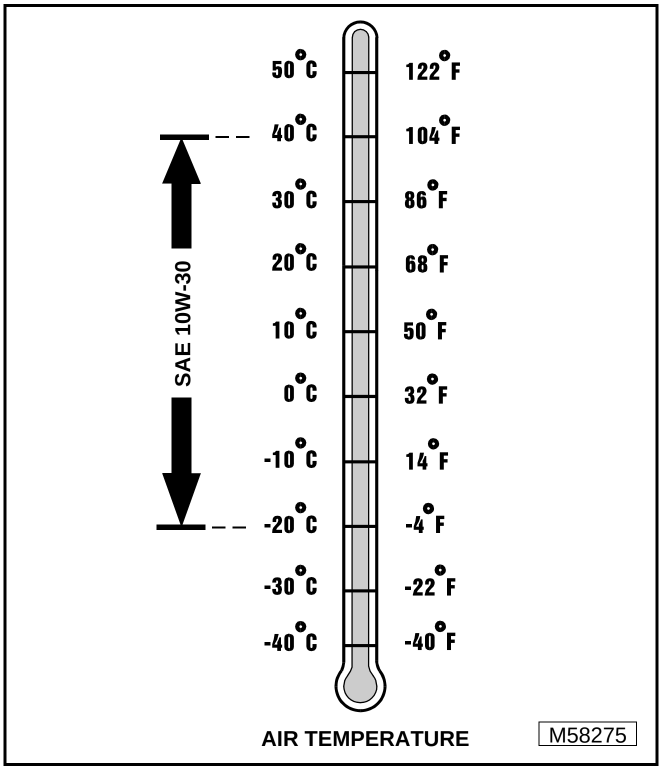
IMPORTANT: ONLY use a quality SAE 10W-30 engine oil in this transmission. DO NOT mix any other oils in this transmission. DO NOT use BIO–HY–GARD® in this transmission.

The following John Deere oil is **PREFERRED**:

- **TORQ-GARD SUPREME®—SAE 10W-30.**

Other oils may be used if above recommended John Deere oils are not available, provided they meet one of the following specifications:

- CCMC Specification G4 or higher.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

- Module DX,ENOIL2 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide.

ALTERNATIVE LUBRICANTS

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than the ones printed in this technical manual or the operator's manual. Consult with your John Deere Dealer, or Sales Branch, to obtain the alternative lubricant recommendations.

IMPORTANT: Use of alternative lubricants could cause reduced life of the component.

If alternative lubricants are to be used, it is recommended that the factory fill be thoroughly removed before switching to any alternative lubricant.

SYNTHETIC LUBRICANTS

Synthetic lubricants may be used in John Deere equipment if they meet the applicable performance requirements (industry classification and/or military specification) as shown in this manual.

The recommended air temperature limits and service or lubricant change intervals should be maintained as shown in the operator’s manual.

Avoid mixing different brands, grades, or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements. Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

LUBRICANT STORAGE

All machines operate at top efficiency only when clean lubricants are used. Use clean storage containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination. Store drums on their sides. Make sure all containers are properly marked as to their contents. Dispose of all old, used containers and their contents properly.

MIXING OF LUBRICANTS

In general, avoid mixing different brands or types of lubricants. Manufacturers blend additives in their lubricants to meet certain specifications and performance requirements. Mixing different lubricants can interfere with the proper functioning of these additives and lubricant properties which will downgrade their intended specified performance.

OIL FILTERS

IMPORTANT: Filtration of oils is critical to proper lubrication performance. Always change filters regularly.

The following John Deere oil filters are PREFERRED:

- AUTOMOTIVE AND LIGHT TRUCK ENGINE OIL FILTERS.

Most John Deere filters contain pressure relief and anti-drainback valves for better engine protection.

Other oil filters may be used if above recommended John Deere oil filters are not available, provided they meet the following specification:

- ASTB Tested In Accordance With SAE J806.

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil filter for your customers:

- Module DX,FILT in JDS–G135;
- Section 540, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lawn & Grounds Care Tune-Up Guide PI672.

GEAR TRANSMISSION GREASE

Use the following gear grease based on the air temperature range. Operating outside of the recommended grease air temperature range may cause premature gear transmission failure.

IMPORTANT: ONLY use these specified greases in this transmission. DO NOT mix any other greases in this transmission. DO NOT use any BIO–GREASE in this transmission.

ONLY use the following **PREFERRED** grease as the **input shaft needle bearing** lubricant:

- **Unirex N3 Grease®—M120263.**

Other greases may be used as the input shaft needle bearing lubricant if they meet or exceed the following specification:

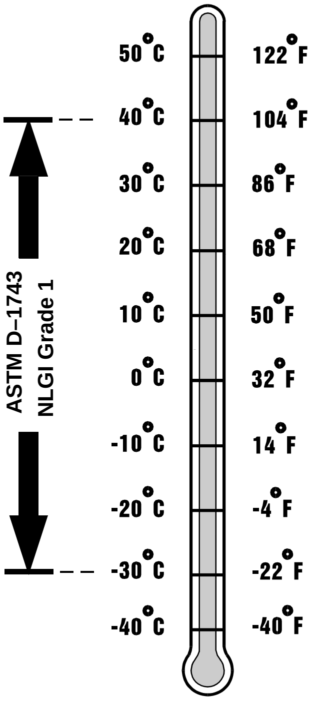
- ASTM D–1743, NLGI Grade 1.

ONLY use the following **PREFERRED** grease as the **gear housing** lubricant:

- **Shell Darina D Grease®—AM119608.**

Other greases may be used as the gear housing lubricant if they meet or exceed the following specification:

- ASTM D–1743, NLGI Grade 1.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:

- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

ANTI-CORROSION GREASE SPECIFICATIONS

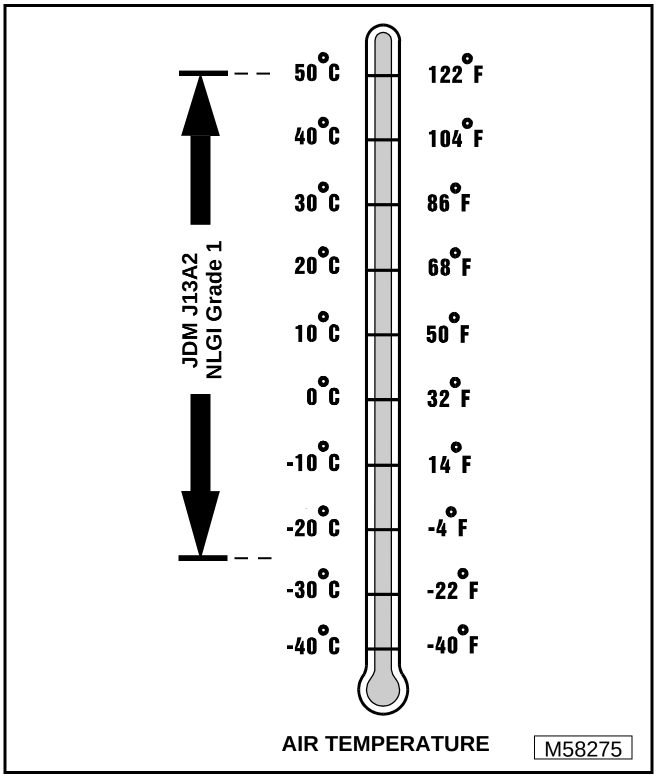
This anti-corrosion grease is formulated to provide the best protection against absorbing moisture, which is one of the major causes of corrosion. This grease is also superior in its resistance to separation and migration.

The following anti-corrosion grease is **PREFERRED**:

- **DuBois MPG-2® Multi-Purpose Polymer Grease—M79292.**

Other greases may be used if they meet or exceed the following specifications:

- John Deere Standard JDM J13A2, NLGI Grade 1.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:

- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

GREASE SPECIFICATIONS

GREASE - NORTH AMERICA

Use the following grease based on the air temperature range. Operating outside of the recommended grease air temperature range may cause premature failures.

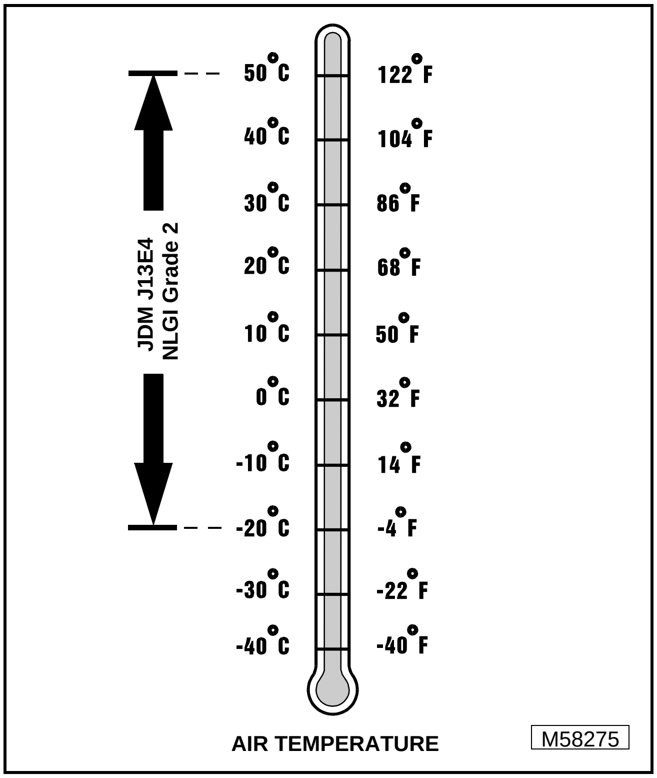
IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO–GREASE in this application.

The following John Deere grease is **PREFERRED**:

- **NON-CLAY HIGH-TEMPERATURE EP GREASE®—JDM J13E4, NLGI Grade 2.**

Other greases may be used if above preferred John Deere grease is not available, provided they meet the following specification:

- John Deere Standard JDM J13E4, NLGI Grade 2.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:

- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- Lubrication Sales Manual PI7032.

GREASE - EUROPE

Use the following grease based on the air temperature range. Operating outside of the recommended grease air temperature range may cause premature failures.

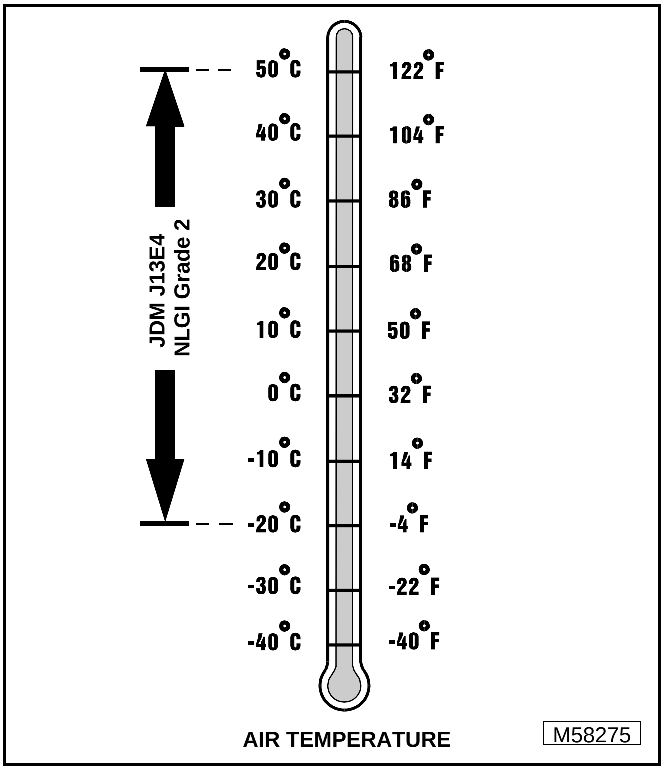
IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO–GREASE in this application.

The following John Deere grease is **PREFERRED**:

- **GREASE–GARD™—JDM J13E4, NLGI Grade 2.**

Other greases may be used if above preferred John Deere grease is not available, provided they meet the following specification:

- John Deere Standard JDM J13E4, NLGI Grade 2.



John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:

- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide.

SERIAL NUMBER LOCATIONS

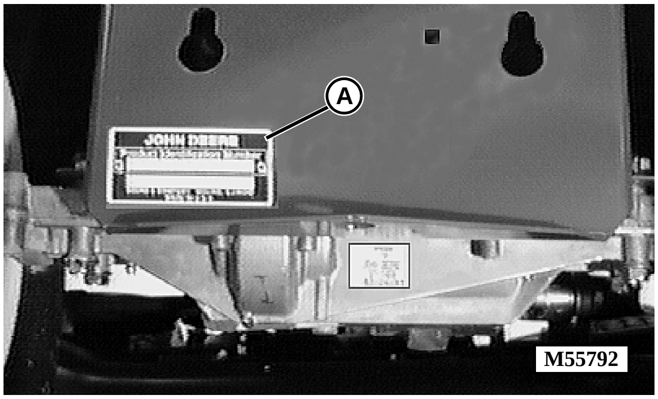
ENGINE SERIAL NUMBER SUFFUX

Domestic	Australia	Export
STX38/Gear/12.5 (Steel Cam) = 8	STX38/Gear/12.5 (Steel Cam) = 8	STX38/Gear/12.5 (Plastic Cam) =4
STX38/Hydro/12.5 (Steel Cam) = 8	STX38/Hydro/12.5 (Steel Cam) =8	STX38/Hydro/14 (Plastic Cam) =9
STX46/Gear/14 (Plastic Cam) = 9	STX46/Gear/14 (Plastic Cam) = 9	
STX46/Hydro/14 (Plastic Cam) =9	STX46/Hydro/14 (Plastic Cam) =9	

IMPORTANT: When working on machines or components that are covered by warranty, it is IMPORTANT that you include the transporter product identification number and the component serial numbers on the warranty claim form.

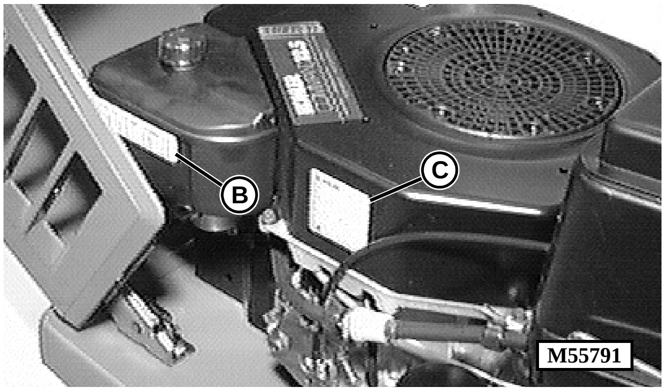
The location of transporter identification number and component serial numbers are shown.

TRACTOR IDENTIFICATION NUMBER



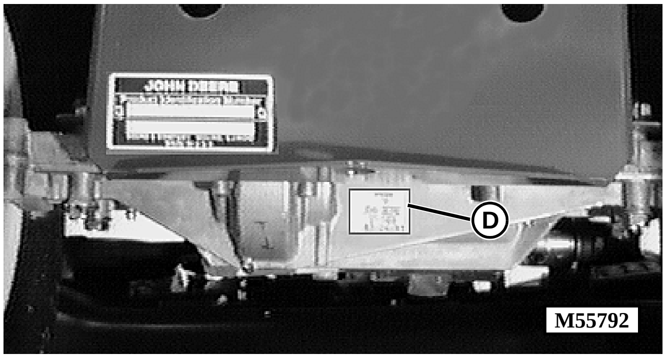
Tractor identification number plate (A) is located on the rear of frame.

ENGINE SERIAL NUMBER



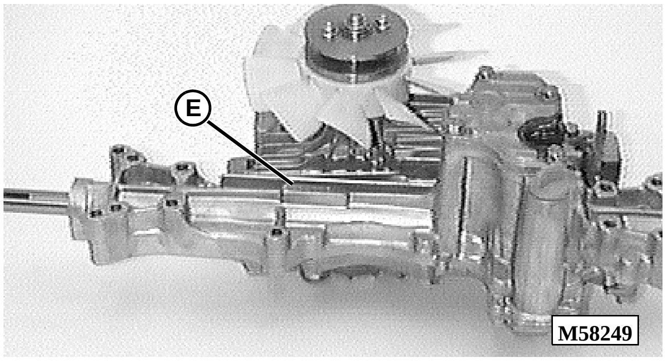
Tractor engine serial number sticker (C) is located on fan shroud and bar code sticker (B) is on air filter housing on left side of engine.

GEAR TRANSAXLE SERIAL NUMBER



Gear transaxle serial number sticker (D) is on rear of housing.

HYDROSTATIC TRANSMISSION SERIAL NUMBER



Serial number (E) is stamped into top of upper case half. It is only accessible with hydro removed.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Make	Kohler
Style	Command LT
STX30	CV12.5—1216s
STX38 (Serial No. —270000)	CV12.5—1215
STX38 (Domestic & Export) (Serial No. 210001—270000)	CV12.5S—1270
STX38 (Export Gear) (Serial No. 270001—595000)	CV12.5S—1270
STX38 (Domestic Gear & Hydro) (Serial No. 270001—595000)	CV13S—21509
STX38 (Export Hydro) (Serial No. 240001—270000)	CV14S—1463
STX38 (Export Hydro) (Serial No. 270001—595000)	CV14S—1463
STX46 (Domestic Gear & Hydro) (Serial No. 240001—270000)	CV14S—1463
STX46 (Domestic Gear & Hydro) (Serial No. 270001—595000)	CV15S—41521
STX46 (Australia Hydro) (Serial No. 270001—595000)	CV15S—41521
Type	Gasoline, Air Cooled, Single Cylinder, 4-Cycle, Overhead Valve
Power: CV12.5—1270	9.33 kW (12.5 hp)
CV13S—21509	9.69 kW (13.0 hp)
CV14S—1463	10.5 kW (14.0 hp)
CV15S—41521	11.19 kW (15.0 hp)
Bore (12.5, 13, 14 hp)	87 mm (3.43 in.)
Bore (15 hp)	90 mm (3.60 in.)
Stroke (All)	67 mm (2.64 in.)
Displacement (12.5, 13, 14 hp)	398 cc (24.3 cu-in.)
Displacement (15 hp)	426 cc (26.0 cu-in.)
Compression Ratio	2:1 Cranking—8.5:1 Running
Compression Release	Automatic/Centrifugal
Crankshaft Type	Vertical (counterbalanced)
Lubrication	Gerotor Pump (0—60 psi)
Oil Filter	Full Flow (W/O By-Pass Valve)
Oil	John Deere Turf-Gard
Warm Climate	10W30
Cold Climate	5W30
Crankcase Capacity (with filter)	1.8 L (1.9 U.S. qt)
Lubrication Interval	50 Hours First Change, Every 100 Hours After or Yearly
Air Filter	Paper With Outer Foam Element
Fuel Filter	Replaceable (In-Line Type)
Fuel Type	Regular Unleaded—87 Octane Or Higher
Gasoline/Alcohol Blends	Up To 10% Ethyl Alcohol-90% Unleaded (By Volume)
Gasoline/Ether Blends	Up To 15% MTBE-85% Unleaded (By Volume)
Fuel Shut-Off Valve	Replaceable (In-Line Type)
Fuel Shut-Off Solenoid (Optional)	Replaceable (Below Carburetor Float Bowl)
Weight	39.54 kg (87 lbs)

TEST AND ADJUSTMENT SPECIFICATIONS

Engine:

Valve Adjustment	None (hydraulic lifters)
Oil Pressure (Minimum at 1250 rpm)	124 kPa (18 psi)
Crankcase Vacuum (Minimum At Operating Temp.)	25 mm (1 in.) Water Movement
Automatic Compression Release Minimum Lift (Engine Cold)	0.25 mm (0.01 in.)

Fuel/Air System:

Carburetor Slow Idle Mixture Screw Initial Setting	Lightly Seat, Then 1 Turn Out
Slow Idle Speed—Domestic and Export	1650 ±75 rpm
Fast Idle Speed—Domestic	3350 ±50 rpm
Fast Idle Speed—Export	3000 ±50 rpm

REPAIR SPECIFICATIONS

Cylinder Head:

Cylinder Head Flatness (Maximum Warpage)	0.076 mm (0.003 in.)

Push Rod:

Maximum Bend	0.76 mm (0.030 in.)

Valves and Valve Lifters:

Hydraulic Lifter Clearance	0.0124—0.0501 mm (0.0005—0.0020 in.)
Intake Valve-to-Guide Clearance	0.038—0.076 mm (0.0015—0.0030 in.)
Intake Valve Stem OD	6.982—7.000 (0.2749—0.2756 in.)
Exhaust Valve Stem OD	6.970—6.988 (0.2744—0.2751)
Exhaust Valve-to-Guide Clearance	0.050—0.088 mm (0.0020—0.0035 in.)
Intake Valve Guide ID:	
New	7.038—7.058 mm (0.2771—0.2779 in.)
Maximum	7.134 mm (0.2809 in.)
Exhaust Valve Guide ID:	
New	7.038—7.058 mm (0.2771—0.2779 in.)
Maximum	7.159 mm (0.2819 in.)
Valve Guide Reamer:	
Standard	7.048 mm (0.2775 in.)
Oversize (0.25 mm)	7.298 mm (0.2873 in.)
Intake Valve Lift (Minimum—Engine Cold)	8.96 mm (0.353 in.)
Exhaust Valve Lift (Minimum—Engine Cold)	9.14 mm (0.360 in.)
Valve Face Angle	45°
Valve Seat Angle	44.5

REPAIR SPECIFICATIONS (Continued)

Rocker Arms:

Rocker Arm I.D.

New	15.837—16.127 mm (0.63—0.64 in.)
Wear Limit	15.727 mm (0.619 in.)

Rocker Shaft:

Rocker Shaft O.D.

New	15.837—16.127 mm (0.63—0.64 in.)
Wear Limit	15.727 mm (0.619 in.)

Crankshaft:

End Play	0.0575—0.4925 mm (0.0023—0.0194 in.)

Crankshaft Bore (Crankcase Half) ID:

New	44.965—45.003 mm (1.7703—1.7718 in.)
Maximum	45.016 mm (1.7723 in.)
Clearance (New)	0.03—0.09 mm (0.0012—0.0035 in.)

Crankshaft Bore (Oil Pan Half):

New	44.965—45.003 mm (1.7703—1.7718 in.)
Maximum	45.016 mm (1.7723 in.)
Clearance (New)	0.03—0.09 mm (0.0012—0.0035 in.)

Main Bearing Journal OD (Flywheel End):

New	44.913—44.935 mm (1.7682—1.7691 in.)
Minimum	44.84 mm (1.765 in.)
Maximum Taper	0.022 mm (0.0009 in.)
Maximum Out-of-Round	0.025 mm (0.0010 in.)

Main Bearing Journal OD (Oil Pan End):

New	41.915—41.935 mm (1.6502—1.6510 in.)
Minimum	41.86 mm (1.648 in.)
Maximum Taper	0.020 mm (0.0008 in.)
Maximum Out-of-Round	0.025 mm (0.0010 in.)

Connecting Rod Journal OD:

New	38.958—38.970 mm (1.5338—1.5343 in.)
Minimum	38.94 mm (1.5328 in.)
Maximum Taper	0.012 mm (0.0005 in.)
Maximum Out-of-Round	0.025 mm (0.0010 in.)

Crankshaft Total Indicated Runout (TIR):

PTO End (In Engine)	0.15 mm (0.0059 in.)
Entire Crankshaft (In Bench V-Blocks)	0.10 mm (0.0039 in.)

REPAIR SPECIFICATIONS (Continued)

Camshaft:

End Play	0.076—0.127 mm (0.003—0/005 in.)
Clearance	0.025—0.063 mm (0.0010—0.0025 in.)
Bore ID:	
New	20.000—20.025 mm (0.7874—0.7884 in.)
Maximum	20.038 mm (0.7889 in.)
Bearing OD:	
New	19.962—19.975 mm (0.7859—0.7864 in.)
Minimum	19.959 mm (0.7858 in.)

Balance Shaft:

End Play	0.0575—0.3625 mm (0.0023—0.0143 in.)
Clearance	0.025—0.063 mm (0.0009—0.0025 in.)
Bore ID:	
New	20.000—20.025 mm (0.7874—0.7884 in.)
Maximum	20.038 mm (0.7889 in.)
Balance Shaft Bearing OD:	
New	19.962—19.975 mm (0.7859—7864 in.)
Minimum	19.959 mm (0.7858 in.)

Cylinder Bore, Piston and Rings:

Cylinder Bore ID (12.5, 13, 14 hp):	
New	87.000—87.025 mm (3.4252—3.4262 in.)
Maximum	87.063 mm (3.4277 in.)
Cylinder Bore ID (15 hp):	
New	90.000—90.025 mm (3.5433—3.5443 in.)
Maximum	90.63 mm (3.5681 in.)
Maximum Out-of-Round	0.12 mm (0.0047 in.)
Maximum Taper	0.05 mm (0.0020 in.)
Piston-To-Pin Clearance	0.006—0.017 mm (0.0002—0.0007 in.)
Piston Pin Bore ID:	
New	19.006—19.012 mm (0.7483—0.7485 in.)
Maximum	19.025 mm (0.7490 in.)
Piston Pin OD:	
New	18.995—19.000 mm (0.7478—0.7480 in.)
Minimum	18.994 mm (0.74779 in.)
Top Compression Ring-To-Groove Side Clearance	
12.5, 13, 14 hp	0.040—0.105 mm (0.0016—0.0041 in.)
15 hp	0.060—0.105 mm (0.0023—0.0041 in.)
Middle Compression Ring-To- Groove Side Clearance	
12.5, 13, 14 hp	0.040—0.072 mm (0.0016—0.0028 in.)
15 hp	0.040—0.085 mm (0.0015—0.0002 in.)
Oil Control Ring-To-Groove Side Clearance	
12.5, 13, 14 hp	0.551—0.675 mm (0.0217—0.0266 in.)
15 hp	0.176—0.026 (0.0069—0.0010 in.)
Top and Center Compression Ring End Gap	
New Bore:	
12.5, 13, 14 hp	0.3—0.5 mm (0.012—0.020 in.)
15 hp	0.27—0.51 mm (0.010—0.020 in.)
Used Bore (Maximum)	
All	0.77 mm (0.030 in.)

REPAIR SPECIFICATIONS (Continued)

- Piston Thrust Face OD:
  - New:
    - 12.5, 13, 14 hp . . . . 86.941—86.959 mm (3.4229—3.4236 in.)
    - 15 hp . . . . 89.951—89.969 mm (3.5413—3.5420 in.)
  - Minimum:
    - 12.5, 13, 14 hp . . . . 86.814 mm (3.4179 in.)
    - 15 hp . . . . 89.824 mm (3.5363 in.)
- Piston Thrust Face-To-Cylinder Bore Clearance
  - New:
- 12.5, 13, 14 hp . . . . 0.041—0.044 mm (0.0016—0.0017 in.)
- 15 hp . . . . 0.031—0.043 mm (0.0012—0.0016 in.)

Connecting Rod:

- Crankpin End Clearance
  - New . . . . 0.030—0.055 mm (0.0012—0.0022 in.)
  - Maximum . . . . 0.07 mm (0.0025 in.)
  - Side . . . . 0.18—0.41 mm (0.007—0.016 in.)
- Piston Pin Clearance . . . . 0.015—0.028 mm (0.0006—0.0011 in.)
- Piston Pin End ID:
  - New . . . . 19.015—19.023 mm (0.7486—0.7489 in.)
  - Maximum . . . . 19.036 mm (0.7495 in.)

Governor::

- Crankcase Cross Shaft Bore ID:
  - New . . . . 6.025—6.050 mm (0.2372—0.2382 in.)
  - Maximum . . . . 6.063 mm (0.2387 in.)
- Cross Shaft OD:
  - New . . . . 5.975—6.000 mm (0.2352—0.2362 in.)
  - Minimum. . . . . 5.962 mm (0.2347 in.)
- Crankcase Bore-To-Cross Shaft Clearance. . . . 0.025—0.075 mm (0.0010—0.0030 in.)
- Gear Shaft OD:
  - New . . . . 5.990—6.000 mm (0.2358—0.2362 in.)
  - Minimum. . . . . 5.977 mm (0.2353 in.)
- Gear Shaft-To- Gear Bore Clearance . . . . 0.015—0.140 mm (0.0006—0.0055 in.)

TORQUE SPECIFICATIONS

(Alphabetical Order)

Air Cleaner Base Nut	9.9 N•m (88 lb-in.)
Cylinder Head Cap Screw	41 N•m (30 lb-ft.)
Connecting Rod Cap Screws:	
8mm Straight Shank Bolt	22.6 N•m (200 lb-in.)
Step Down Shank Bolt	14.6 N•m (130 lb-in.)
6mm Straight Shank Bolt	11.3 N•m (100 lb-in.)
Engine Mounting Cap Screws	27.1—46.2 N•m (240—408 lb-in.)
Fan Cap Screw	9.9 N•m (88 lb-in)
Flywheel Cap Screw	68 N•m (50 lb-ft)
Fuel Pump/Cover Screw	
New Installation (Thread Forming)	9.0 N•m (85 lb-in.)
Replacement	7.3 N•m (65 lb-in.)
Fuel Bowl Nut	4.0 N•m (35 lb-in.)
Governor Control Panel Screw	9.9 N•m (88 lb-in.)
Ignition Module Screw	
New Installation (Thread Forming)	6.2 N•m (55 lb-in.)
Replacement	4.0 N•m (35 lb-in.)
Muffler Nut	24.4 N•m (216 lb-in.)
Oil Filter	5.7—9.0 N•m (50—80 lb-in.)
Oil Filter Drain Plug	7.3—9.0 N•m (65—80 lb-in.)
Oil Pan Cap Screw	24.4 N•m (216 lb-in.)
Oil Pump Cover Screw	
New Installation (Thread Forming)	6.2 N•m (55 lb-in.)
Replacement	4.0 N•m (35 lb-in.)
Rocker Arm Pivot Cap Screw	14 N•m (124 lb-in.)
Spark Plug	38—43.4 N•m (28—32 lb-ft)
Stator Cap Screw	4.0 N•m (35 lb-in.)
Valve Cover Cap Screw	
New Installation (Thread Forming)	10.7 N•m (95 lb-in.)
Replacement	7.3 N•m (65 lb-in.)

SERVICE EQUIPMENT AND TOOLS

Order tools from your SERVICEGARD Catalog.
Some tools may be available from a local supplier.

Name	Use
Valve Spring Compressor	Remove and install valve springs
Telescoping Gauge	Measure valve guides Measure inside diameter of parts.
Outside Micrometer	Measure valve stem Measure outside diameter of parts. Measure camshaft journals & lobes
Valve Guide Reamer	Ream valve guides
Valve Seat Cutter	Cut valve seats
Dial Indicator	Check push rods and valves for bend Measure crankshaft end play.
Vacuum Cup Tool	Lap valve
Strap Wrench	Hold flywheel
Telescoping Gauge	Measure camshaft bearing surface Measure cylinder I.D.
Ridge Reamer	Clean cylinder bore.
Piston Ring Expander	Remove and install piston rings.
Ring Compressor	Install piston.
Ring Groove Cleaner	Clean piston ring grooves.
Seal Driver	Install oil seals.
Cylinder Hone	Bore cylinder block.
Flex Hone	Deglaze/crosshatch cylinder.
Oil Pressure Test Kit	Perform Oil Pressure Test

ESSENTIAL TOOLS

Number	Name	Use
D20020WI	Standard Size Valve Guide Reamer (7.05 mm)	Clean or size valve guide to original size.
D05351ST	Spark Tester	Tests spark plug
JDG705	Oversize Valve Guide Reamer (7.25 mm)	Bores valve guide to proper size for oversize valve.

OTHER MATERIALS

Number	Name	Use
	RTV Silicone Sealant	Seal valve cover.
	Prussian Blue Compound	Check valve seat contact.
	Valve Lap Compound	Lap valves.
	SCOTCH-BRITE® Pad	Clean cylinder head.
	Zinc Oxide/Wood Alcohol	Check block for cracks.

SCOTCH-BRITE® is a trademark of the 3M Company.

SERVICE PARTS KITS

The following kit is available through your parts catalog:

Camshaft Shim Kit, Oversize Piston and Ring Kits, Undersize Connecting Rod, Oil Pressure Test Kit.

TROUBLESHOOTING

Problem or Symptom Check or Solution	Engine cranks but will not start or starts hard	Engine will not stay running or runs rough	Engine stalls frequently	Engine backfires	Engine surges, uneven or uncontrolled rpm	Engine misses	Low power under load	Engine has no spark	Engine will not crank	Exhaust black, engine floods or burns rich	Exhaust smoke blue or high oil consumption	Engine has low oil pressure	Fuel in oil	Engine overheats	Excessive engine noise or vibration start or starts hard
Spark plug fouled or incorrect gap. Incorrect spark plug.	●	●	●		●	●	●	●		●					●
Defective ignition components.	●	●	●	●	●	●	●	●	●	●					●
Starter worn. Cranking rpm too slow, cables corroded, battery weak. Engine overloaded.	●	●	●				●		●			●		●	●
Fuel tank outlet restricted, shut-off valve not fully open, fuel filter or line restricted. Fuel stale, contains water, or wrong type.	●	●	●	●	●	●	●			●	●		●		●
Air filter element plugged or oil soaked.	●	●	●		●	●	●			●					●
Choke, throttle, or governor linkage worn or out of adjusted. Carburetor set too rich.	●	●	●	●	●	●	●		●	●					●
Carburetor worn, contaminated with debris or varnish. Passages plugged. Wrong jets or adjusted too lean.	●	●	●	●	●	●	●								●
Carburetor, intake manifold, or cylinder head gaskets leaking.	●	●	●	●	●	●	●								●
Low compression: worn piston, rings, cylinder, valves. Warped head.	●	●	●		●	●	●				●	●	●	●	●
Valve clearance incorrect. Burned or warped valves and seats. Defective springs.	●	●	●	●	●	●	●								●

Problem or Symptom Check or Solution	Engine cranks but will not start or starts hard	Engine will not stay running or runs rough	Engine stalls frequently	Engine backfires	Engine surges, uneven or uncontrolled rpm	Engine misses	Low power under load	Engine has no spark	Engine will not crank	Exhaust black, engine floods or burns rich	Exhaust smoke blue or high oil consumption	Engine has low oil pressure	Fuel in oil	Engine overheats	Excessive engine noise or vibration start or starts hard
Engine oil viscosity or level incorrect. Engine oil filter restricted. Oil pump worn or passages obstructed.	●	●					●		●			●		●	●
Engine gaskets or seals leaking.	●	●	●	●	●	●	●				●	●	●	●	●
Crankcase breather restricted, reed valve damaged, clearance incorrect, or drain hole plugged.	●	●	●		●		●		●		●	●		●	
Valve guides or seals worn or leaking. Valve stems worn.	●	●	●	●	●	●	●				●			●	●
Worn, stuck, or broken piston rings. Cylinder bore worn. Check compression and vacuum.	●	●	●	●	●	●	●				●	●	●	●	●
Connecting rod or crankshaft bearings worn. Internal wear limits out of specification.	●	●	●		●		●					●		●	●
Engine mounting hardware loose or broken.					●		●								●

Continued on next page

Problem or Symptom Check or Solution	Fuel overflows carburetor vent	Engine stops when hot	Engine races or runs one speed	Engine clatters	Engine won't run	White smoke on start-up	Engine runs slow &clicks	Engine runs on after shutdown	Engine won't shut off	Hydraulic lifters are noisy	Bent push rods after new lifters were installed	Hydraulic lifters over-extended.
Dirt in carburetor. Float sticking. Clean carb, replace filter, check float.	●											
Vapor lock. Check temperature of fuel system. Clear vent in top of fuel cap.		●			●							
Fuel shutoff valve closed.					●							
Move governor shaft with engine running, check for resistance.			●									
Lifter is collapsed.				●	●							
Lifter is stuck in bore.				●	●							
Water in fuel bowl of carburetor.					●	●						
Engine RPM too low; automatic compression release still on. Adjust low idle speed.				●			●					
Inspect ignition switch and ground.								●	●			
Inspect engine ground cable								●	●			
Adjust idle speed to specs. Move throttle to idle before shutdown.								●		●		●
Inspect piston, valves, cylinder head & exhaust for high carbon build-up.								●		●		●
"Prime" hydraulic lifters											●	●
"Bleed" hydraulic lifters											●	●
Check oil level										●		

NOTES

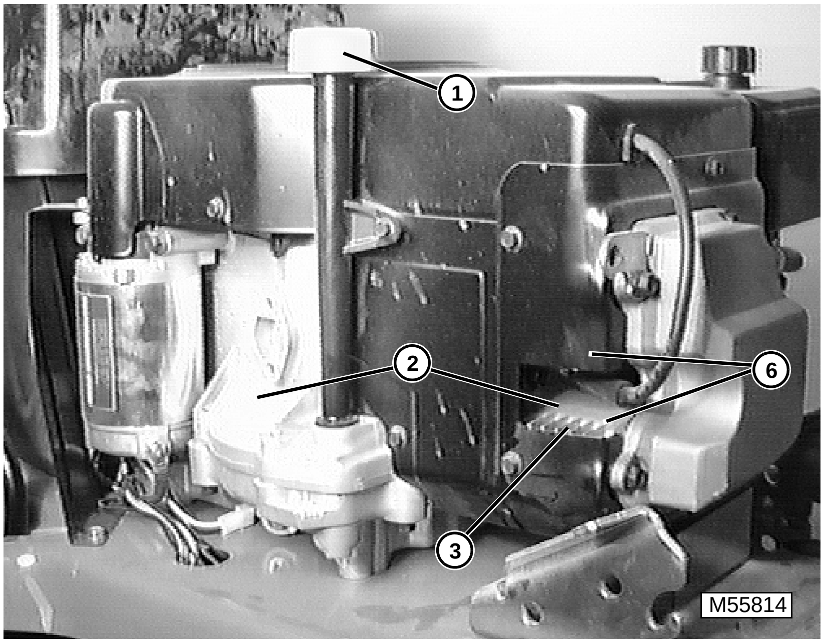
DIAGNOSIS

MAIN COMPONENTS

Test Conditions:

- Machine PARKED on level surface.
- Park brake LOCKED.
- Key switch OFF.
- Transaxle/Hydro in NEUTRAL.

Test/Check Point	Normal	If Not Normal
1. Engine dipstick.	Oil level between “L” and “F” marks on dipstick.	Add proper amount of oil to bring level to “F” mark.
	Oil not burnt or contaminated with metal particles or fuel.	Change oil and filter and inspect for cause of contamination.
	Minimum crankcase vacuum 101.6 mm (4 in.).	Check breather. Check gaskets and seals for leaks.
2. Crankcase, head, and oil filter.	No external oil leakage and filter element clean.	Replace leaky gaskets, seals, oil filter, or drain plug.
3. Cylinder head.	Minimum compression 345 kPa (50 psi).	Adjust valves. Check ACR. Check condition of valves, pistons, rings, cylinders.
4. Carburetor.	Float chamber full of clean fresh fuel.	Check for fuel in tank. Replace fuel in tank. Check tank vent. Check for plugged, damaged or pinched fuel lines.
	Needle valve, passages, and jets free from varnish or debris.	Clean or replace carburetor.
	Float assembly functioning properly.	Replace components as necessary.
	Main jet correct for elevation.	Replace main jet with correct size.
	SLOW idle 1650 ± 75 rpm. Domestic FAST idle 3350 ± 50 rpm. Export FAST idle 3000 ± 50 rpm.	Check linkage and adjust carburetor.
	Choke, throttle, and governor set and functioning properly.	Check linkage and adjust.
5. Air filter.	Air filter element and canister clean and undamaged.	Replace filter. Repair or replace canister.
	Hardware tight.	Tighten or replace hardware.
6. Fan, cylinder and head fins.	Fan shroud and cylinder/head fins clean.	Clean thoroughly.
	Fins not cracked or broken.	Replace fan or cylinder or head.
7. Internal components.	Wear within limits, all hardware tight, no excessive vibrations.	Inspect, repair, or replace components as necessary.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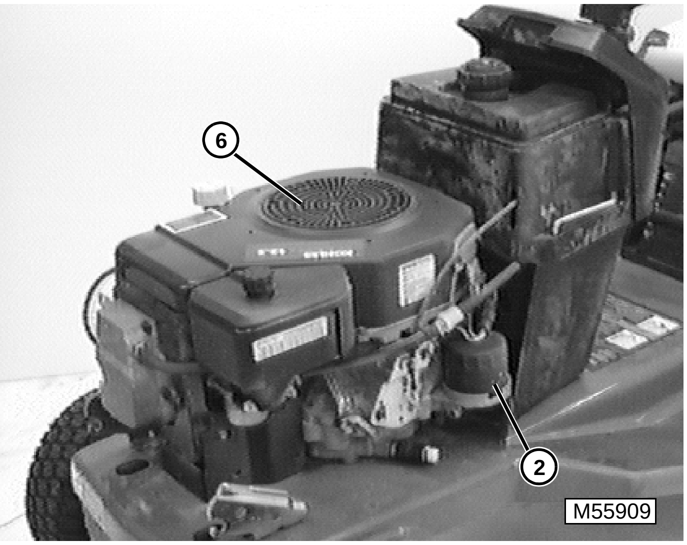
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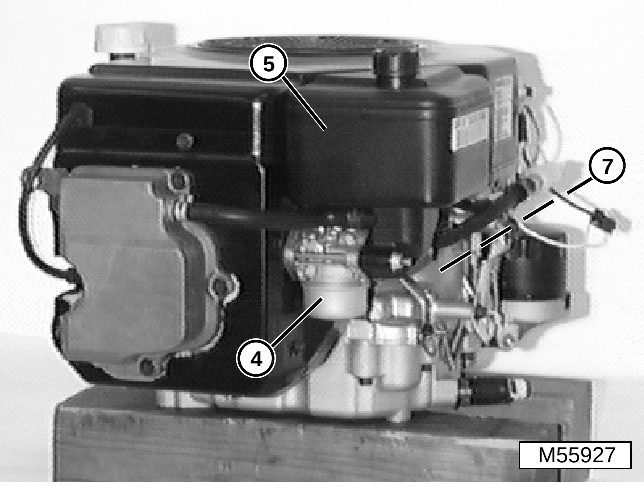
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ENGINE HARD TO START AND/OR ENGINE STARTER KICKS OUT

NOTE: Use correct starting procedure as listed in operator's manual. The procedure of cranking the engine for 5 seconds and waiting for 10 seconds will improve starting and decrease total cranking time. The 10 second pause allows fuel in the manifold time to evaporate for improved combustion, reducing the chance of flooding and muffler backfire.

Test Conditions:

- Control lever in full choke position.
- Crank engine for 5 seconds. If engine does not start, pause for 10 seconds, then crank for 5 more seconds. Continue this 5 seconds on, 10 seconds off cycle until engine starts. If starter kicks out see step 8. When engine tries to start, continue cranking beyond the 5 seconds of that cycle until it starts.
- As engine warms up, move choke control back gradually. This will help to lessen excessive exhaust smoke, engine "loading up", or backfire.

Test/Check Point	Normal	If Not Normal
1. Cranking speed.	At least 300 RPM.	If cranking speed is below 300 RPM check the following: Low battery output—Load test battery for correct amperage output. Engine oil weight too heavy.—Only multi-viscosity oil is recommended. Battery or starter terminals corroded. Starter failure. Automatic compression release (ACR) is not working correctly.
2. Choke adjustment.	Choke plate must be completely closed when throttle lever is in full choke position.	Adjust throttle cable, choke, governor, and idle speeds.
3. Spark plug. Use in line spark tester (D-05351ST)	Clean, undamaged, and gapped correctly 1.0 mm (0.04 in.). Spark plug should provide a strong blue spark.	Repair or replace.
4. Carburetor	Must have adequate supply of fresh, clean fuel.	Perform fuel flow test. Connect a remote, gravity feed tank with fresh fuel after performing fuel flow test. This procedure will identify stale fuel problem. Clean carburetor.
5. Air cleaner.	Clean and undamaged.	Clean or replace foam pre-cleaner and air filter element as needed.

Test/Check Point	Normal	If Not Normal
6. Cylinder compression.	40—90 psi	Low compression (below 40 psi) can be the result of a stuck valve or automatic compression release (ACR) not functioning correctly. A stuck valve could be caused by stale fuel or an over extended hydraulic lifter. High compression (above 90 psi) can be the result of the ACR not functioning correctly.
7. Flywheel key.	Not damaged or partially sheared.	Replace
8. Starter	Should not kick out.	Engine oil weight too heavy. Only multi-viscosity oil is recommended. Replace UTC starter with Eaton starter (only replace starter if the proper oil does not provide better starting performance). Eaton starter is standard on 1996 model year STX's (270001—).

ENGINE BACKFIRES, HAS LOW POWER, WILL NOT START, OR TURNS OVER SLOWLY AND LOCKS UP

STX38—EXPORT MODELS ONLY (M00STXC210001—271587) (M00STXE210001—271696)

STX46— (M00STXF240001—270000) (M00STXG240001—270000)

IMPORTANT: Proceed with this diagnosis only after completing the procedures starting on page 3-16.

Test/Check Point	Normal	If Not Normal
1. Plastic cam gear.	Plastic cam gear "Not" rotated on metal hub of camshaft.	Replace plastic gear camshaft with metal gear camshaft. Replace any related valve train components that have been damaged or do not meet specifications. This could include valves, rocker arms, and push rods. Make sure hydraulic lifters are "bled" and "primed" before assembly.
2. Automatic compression release (ACR) spring.	Spring should not be binding on retaining rivet.	Replace plastic gear camshaft with metal gear camshaft.Replace any related valve train components that have been damaged or do not meet specifications. This could include valves, rocker arms, and push rods. Make sure hydraulic lifters are "bled" and "primed" before assembly.

TESTS AND ADJUSTMENTS

THROTTLE CABLE ADJUSTMENT

Reason:

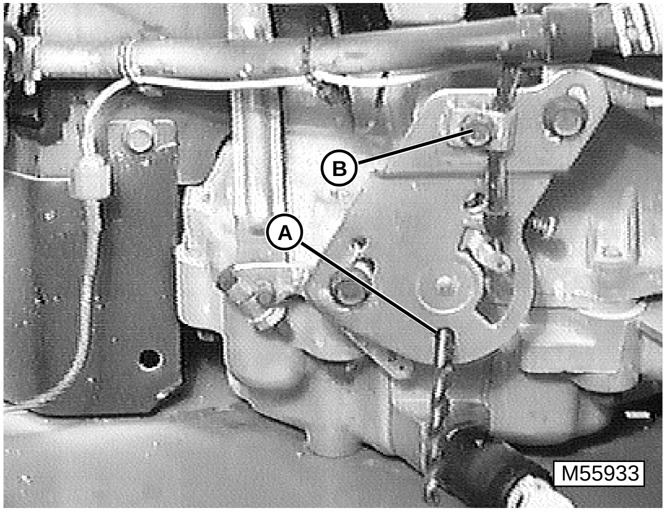
To make sure the throttle cable moves the throttle and choke control lever through its full range of movement.

Equipment:

- 6.4 mm (0.25 in.) Drill Bit

Procedure:

1. Move throttle lever to FAST idle position.



2. Align hole in throttle control lever with hole (A) in throttle control plate. Put a **6.4 mm (0.25-in.)** drill bit through holes to keep the throttle control lever from moving. Be sure drill bit is perpendicular to the throttle control plate.
3. Loosen cap screw (B) and pull throttle cable housing tight. Tighten cap screw.
4. Remove drill bit.
5. Move throttle lever to the full choke position. Make sure throttle lever is held up against throttle plate. Choke should be fully closed.
6. Move throttle lever through full range to be sure linkage is not binding.

CHOKE ADJUSTMENT

Reason:

To make sure the choke plate is fully closed when the throttle lever is in the full choke position. Correct adjustment also makes sure choke is completely open in the fast idle position.

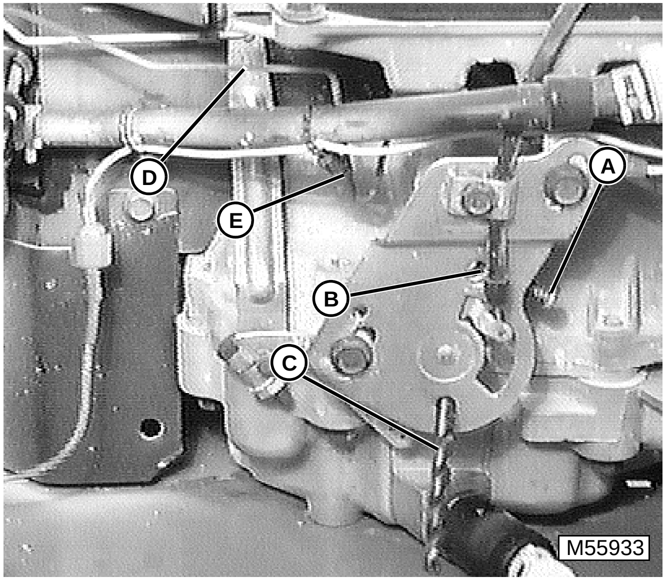
Equipment:

- 6.4 mm (0.25 in.) Drill Bit

Procedure:

NOTE: Adjust throttle cable before adjusting choke.

1. Move throttle lever to CHOKE position then back to FAST idle position.



2. Align hole in throttle control lever with hole in throttle control plate. Put a **6.4 mm (0.25 in.)** drill bit (C) through holes to keep the throttle control lever from moving. Be sure drill bit is perpendicular to the throttle control plate.
3. Turn screw (A) counterclockwise until screw does not contact the choke control lever (B).
4. Turn screw clockwise until screw just touches the choke control lever.
5. Remove drill bit.
6. Move throttle lever to full choke position.
7. Try to move choke rod (D) forward (choke rod should not move). If the choke rod moves forward, the choke plate is not fully closed. Carefully bend the choke rod at Vee bend (E) until the choke plate is fully closed.
8. Move throttle lever to be sure choke linkage is not binding.

GOVERNOR ADJUSTMENT

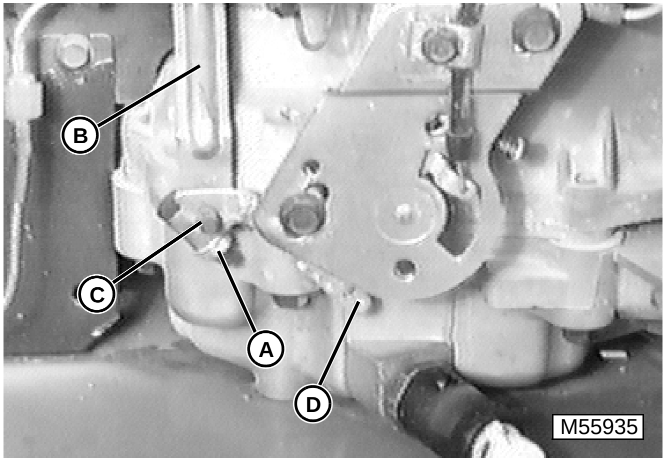
Reason:

To make sure the governor shaft contacts the fly-weight plunger when the engine is stopped.

NOTE: Adjust throttle cable before adjusting governor linkage.

Procedure:

1. Move throttle lever to FAST idle position.



M55935

2. Loosen nut (A).
3. Hold top of governor arm (B) toward carburetor. Turn governor shaft (C) counter-clockwise until it stops. Hold governor shaft and tighten nut.
4. Move throttle lever through full range to be sure linkage is not binding.
5. Governor spring (D) should be installed in the hole closest to governor shaft. If governor is not responding properly, replace spring and readjust fast idle speed. If spring did not correct the problem, repair governor.

FAST IDLE SPEED ADJUSTMENT

Reason:

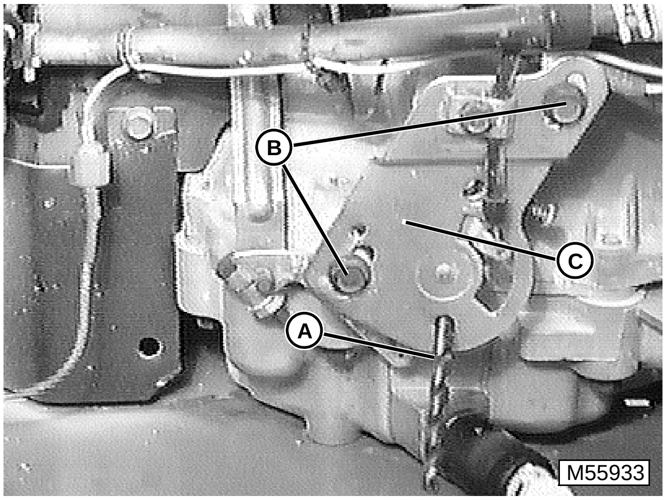
To set engine fast idle rpm.

Equipment:

- JTO5719 Photo Tachometer

Procedure:

1. Move transaxle shift lever to neutral position. Engage park brake.



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2. Put reflective tape on blower housing screen.
3. Start and run engine at MEDIUM idle for five minutes.

⚠ CAUTION

Engine will be HOT. Be careful not to burn skin.

4. Move throttle lever to FAST idle position.
5. Align holes of throttle lever and throttle control plate with 6.4 mm (0.25 in.) drill bit (A). This keeps the throttle control lever from moving during adjustment. Be sure drill bit is perpendicular to the throttle control plate.
6. Use a photo tachometer to check engine rpm at the blower housing screen.

Specifications:

Domestic fast idle speed setting . . . 3350 ± 50 rpm
Export fast idle speed setting . . . . . . 3000 ± 50 rpm
Control panel screw torque. . . . . 9.9 N•m (88 lb-in.)

Results:

- If fast idle speed does not meet the specifications, loosen cap screws (B).
- Move throttle control plate (C) upward to increase rpm or downward to decrease rpm.
- Hold the throttle control plate and tighten cap screws.

SLOW IDLE SPEED ADJUSTMENT NON CARB/EPA (EARLY MODELS)

Reason:

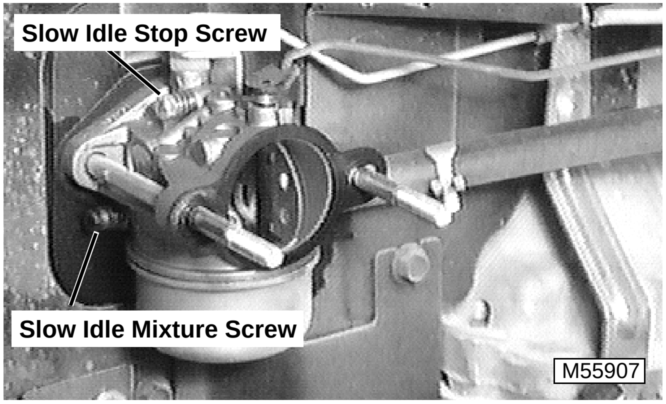
To set engine slow idle mixture and rpm.

Equipment:

- JTO5719 Photo Tachometer

Procedure:

1. Move transaxle to neutral. Engage park brake.



Standard Carburetors—Non CARB/EPA

2. Put reflective tape on outer rim of blower housing screen.

IMPORTANT: DO NOT force the SLOW idle mixture screw tight, this will damage the needle and seat. Air cleaner assembly removed for photo clarity, DO NOT remove for tests.

3. While engine is OFF, turn SLOW idle mixture screw **clockwise (in) until lightly seated, then turn counterclockwise (back-out) one full turn.**
4. Start and run engine at MEDIUM idle for 5 minutes to obtain operating temperature.
5. Move throttle lever to SLOW idle position.
6. Use a photo tachometer to check engine rpm at the blower housing screen reflective timing tape.
7. Turn SLOW idle stop screw in either direction until specified **SLOW idle speed of 1650 ± 75 rpm** is reached.
8. Turn slow idle mixture screw **counterclockwise (back-out) until engine speed drops off (rich mixture)**—Note position of screw at rpm drop-off point.
9. Turn slow idle mixture screw **clockwise (in) until engine speed increases and then drops off (lean mixture)**—Note position of screw at rpm drop-off point.
10. Turn slow idle mixture screw **counterclockwise (back-out) until midpoint (1/8 to 1/4 turn) between rich and lean rpm drop-off points** is reached.

NOTE: It may be necessary to adjust slow idle stop screw again.

11. Recheck slow idle stop screw setting.

Specifications:

SLOW idle stop screw setting. . . . . . 1650 ± 75 rpm

NOTE: For high altitude operation (above 4000 feet), use high altitude carburetor kit, service part number AM119687 (1994 and above) to prevent over rich fuel mixture and black exhaust smoke.

SLOW IDLE SPEED ADJUSTMENT —CARB/EPA STX38 (SN 210001—) & STX46

ATTENTION

DO NOT attempt to adjust carburetors that meet California Air Resource Board/Environmental Protection Agency (CARB/EPA) restrictions unless you are a factory trained technician with authorization to service CARB/EPA Emissions Carburetors. These carburetors can be identified by the black limiter on the slow idle mixture screw.

Reason:

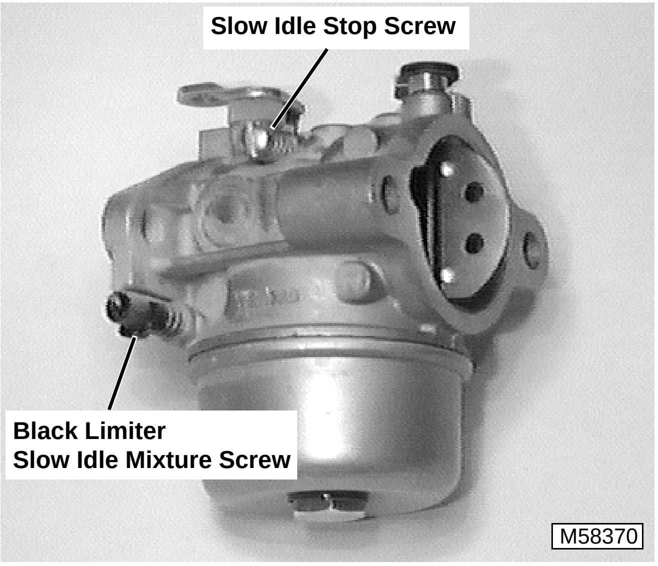
To set engine slow idle mixture and rpm.

Equipment:

- JTO5719 Photo Tachometer

Procedure:

1. Move transaxle to neutral. Engage park brake.



Late Model Carburetors—CARB/EPA

IMPORTANT: DO NOT force the SLOW idle mixture screw tight, this will damage the needle and seat.

2. Put reflective tape on blower housing screen.

NOTE: On CARB/EPA carburetors, no preliminary adjustment is required for black limiter slow idle mixture screw, this is pre-set by manufacturer.

3. Start and run engine at MEDIUM idle for 5 minutes to obtain operating temperature.
4. Move throttle lever to SLOW idle position.
5. Use a photo tachometer to check engine rpm at the blower housing screen reflective timing tape.
6. Turn **Black Limiter** SLOW idle stop screw in either direction until specified **SLOW idle speed of 1650 ± 75 rpm** is reached.

NOTE: It may be necessary to adjust slow idle stop screw again.

7. Recheck slow idle stop screw setting.

Specifications:

SLOW idle stop screw setting. . . . . . 1650 ± 75 rpm

NOTE: For high altitude operation (above 4000 feet), use high altitude carburetor kit, service part number AM119687 (1994 and above) to prevent over rich fuel mixture and black exhaust smoke.

CYLINDER COMPRESSION TEST

Reason:

To check pressure capacity of piston rings and cylinder bore for efficient engine operation.

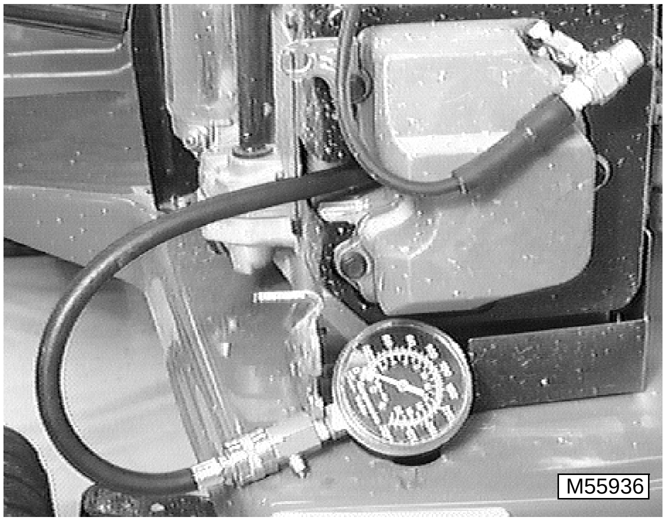
IMPORTANT: On engines equipped with an automatic compression release (ACR) mechanism, a compression test will indicate the ACR compression, not actual compression. A compression test does not provide an adequate method to diagnose the condition of the rings and valves. A cylinder leakdown test is the best method to determine the condition of the rings and valves. By pressurizing the combustion chamber from an external source, you can determine if the valves or rings are leaking.

Equipment:

- JT-03502 Cylinder Leakdown Test Kit —ACR engines only
- JDM-59 Compression Gauge
- JDM-74A-5 Spark Plug Ground Tool

Connections:

1. Move transaxle shift lever to neutral. Engage park brake.


M55936

⚠ CAUTION

Engine components are HOT. DO NOT touch with bare skin, especially the exhaust pipe or muffler while making test. Wear protective eye glasses and clothing.

IMPORTANT: Spark plug wire must be grounded or electronic ignition could be damaged.

2. Disconnect and ground spark plug wire.
3. Remove spark plug and install JDM-59 Compression Gauge.

Procedure:

1. Move the throttle lever to FAST idle position.
2. Crank engine and record compression reading.

Specifications:

Minimum Compression . . . . 345 kPa (50 psi).
Normal Compression. . . . . 550 kPa (80 psi).

Results:

- If compression is low, put clean engine oil on piston rings through spark plug hole. Repeat cylinder compression test.
- IF COMPRESSION PRESSURE INCREASES: check rings, piston and cylinder bore for broken rings, scoring, wear, or damage. Replace as necessary.
- IF COMPRESSION PRESSURE IS STILL LOW: check for leaking intake or exhaust valves, valve seal, or cylinder head gasket. Replace as necessary.

AUTOMATIC COMPRESSION RELEASE (ACR) TEST

Reason:

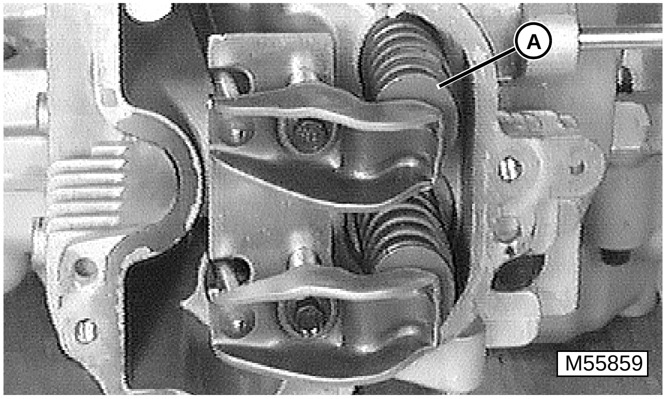
To determine if the automatic compression release is opening the exhaust valve.

Equipment:

- Dial Indicator

Procedure:

1. Remove valve cover and spark plug. Rotate crankshaft slowly to observe ACR operation.



M55859

2. The exhaust valve (A) must open (depress) briefly just after the intake valve closes.
3. Use a dial indicator to measure exhaust valve ACR movement.
4. Install rocker cover, see Remove and Install Cylinder Head in the this section.

Specifications:

Exhaust valve ACR movement
Minimum . . . . 0.25 mm (0.01 in.)

Results:

- If the exhaust valve does not open or depress properly, the automatic compression release tab is faulty and camshaft assembly must be replaced.

CRANKCASE VACUUM TEST

Reason:

To measure the amount of crankcase vacuum, which ensures the crankcase is not pressurized. A pressurized crankcase will force oil past the seals.

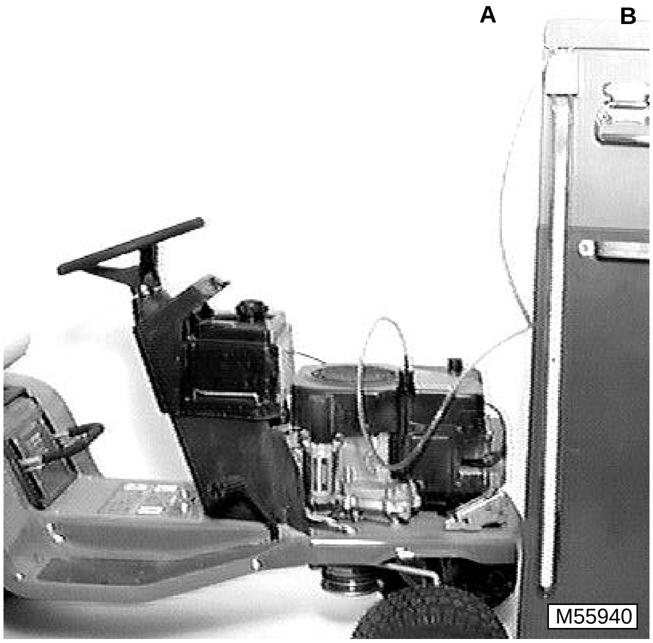
Equipment:

- JTO5697 U-Tube Manometer Kit

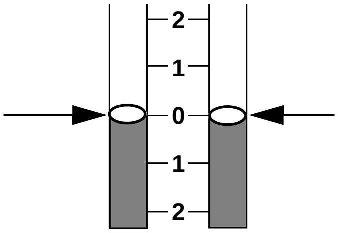
Connections:

1. Attach manometer magnets to solid metal surface.

IMPORTANT: Connecting manometer to engine before starting engine will cause water in the manometer to be drawn into engine crankcase. Do not use more than 3 feet of manometer tubing. If a longer hose is used the manometer readings will be inaccurate. Some engines require a rubber hose (adapter) and hose clamps to fit the dipstick opening while some others require #5 plug to be shortened (cut in-half horizontally) to obtain a tight seal.



2. Open top valves (A) and (B) one full turn.



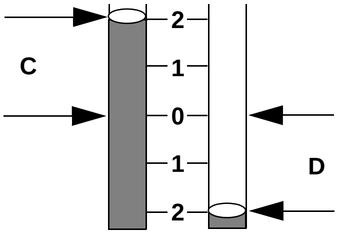
3. Zero out the manometer by sliding the ruled scale up or down so “0” is located where water level is even on both sides.

C **CAUTION**

Engine components are HOT. DO NOT touch with bare skin, especially the exhaust pipe or muffler while making test. Wear protective eye glasses and appropriate clothing.

Procedure:

1. Start and run engine at **FAST idle** to allow engine to reach operating temperature—then move throttle to **SLOW idle**.
2. Quickly remove engine dipstick and attach hose (using adapter or plug) from manometer to dipstick opening.



3. Tighten hose clamp or make sure plug is sealed properly—Move throttle to **FAST idle**.
4. Record vacuum reading. The reading is obtained by adding (C) and (D) water movement from “0”. In this case reading should be 4 inches of vacuum (2 inches + 2 inches—C + D).
5. If water movement (C) is below the “0” mark—crankcase is pressurized causing seals to leak oil. Crankcase should have negative pressure.
6. Repeat test at least three times for accuracy. **DO NOT** shut off engine. To repeat test, remove the manometer tube from top of manometer at valve (A). **DO NOT** remove manometer tube from engine. Be sure to reset manometer at zero—see step 3. Reattach manometer tube to valve (A) and record reading.
7. Remove line from manometer (valve “A”) **before** stopping engine. Then remove dipstick hose, adapter or plug connection and install dipstick.

Results:

Crankcase reading should show a minimum vacuum of **25 mm (1 in.) of water movement**. V-twin engines might show less than 25 mm (1 in.) of water movement; this is not a problem, as long as some vacuum is indicated, engine is operating properly. Check the following if reading is less than minimum specification:

- Breather reed valve clearance and condition;
- Seals and gaskets for leakage, including rocker arm cover gasket;
- Valve and valve seats for wear or damage;
- Rings, piston, and cylinder bore for wear or damage.

FUEL FLOW TEST

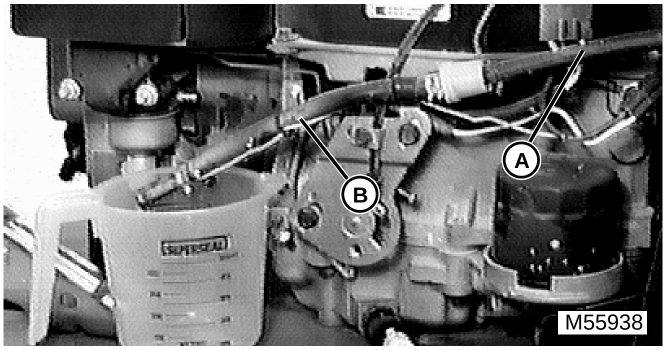
Reason:

To determine fuel availability to the carburetor.

Equipment:

- Proper Fuel Container

Connections:



1. Clamp fuel line (A) or turn off fuel shut-off valve, if equipped, to prevent fuel flow.
2. Disconnect fuel line (B) from carburetor and place in container.

Procedure:

1. Release clamp on fuel line (A) or turn on fuel shut-off valve, if equipped. Fuel should flow freely into container.
2. Clamp line or close valve to install line (B) on carburetor.
3. Pore captured fuel into tank.

Results:

If fuel flow is slow, check the following:

- Replace fuel filter
- Check fuel lines, shut-off valve (if equipped), fuel tank outlet, and fuel tank cap for restrictions

OIL PRESSURE TEST

Reason:

To verify if the engine has enough oil pressure to lubricate internal components.

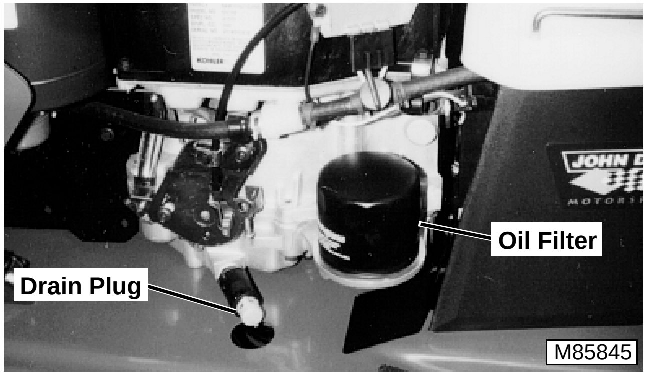
Test Equipment:

- Oil Pressure Test Kit JTO7262
- Fitting JTO5487
- Gauge JTO7034
- Coupler JTO3262
- Hose JTO3017

NOTE: Oil Pressure Test Kit AM122553 has been replaced with SERVICEGARD Oil Pressure Test Kit JTO7262. This kit includes an oil filter adapter and O-ring only. The hose (JTO3017), gauge (JTO7034), coupler (JTO3262), and fitting (JTO5487) are found in other SERVICEGARD test kits.

Procedure:

1. Park machine on level surface, turn key switch OFF, and allow engine to cool.
2. Check engine oil level, bring level to full mark.



⚠ CAUTION

Engine components are HOT. DO NOT touch with bare skin, especially the exhaust pipe or muffler while making test. Wear protective eye glasses and clothing.

For Engines With No Oil Pressure Test Port:

3. Remove oil filter. (Plastic bag may be used to protect paint and channel oil to drain pan).
4. Install pressure tester to oil filter flange.
5. Start engine and run until hot. (Be sure to maintain full crankcase oil level during testing).
6. Check oil pressure when oil is both cold and hot, and at both idle and full throttle.

For Engines With Oil Pressure Test Port:

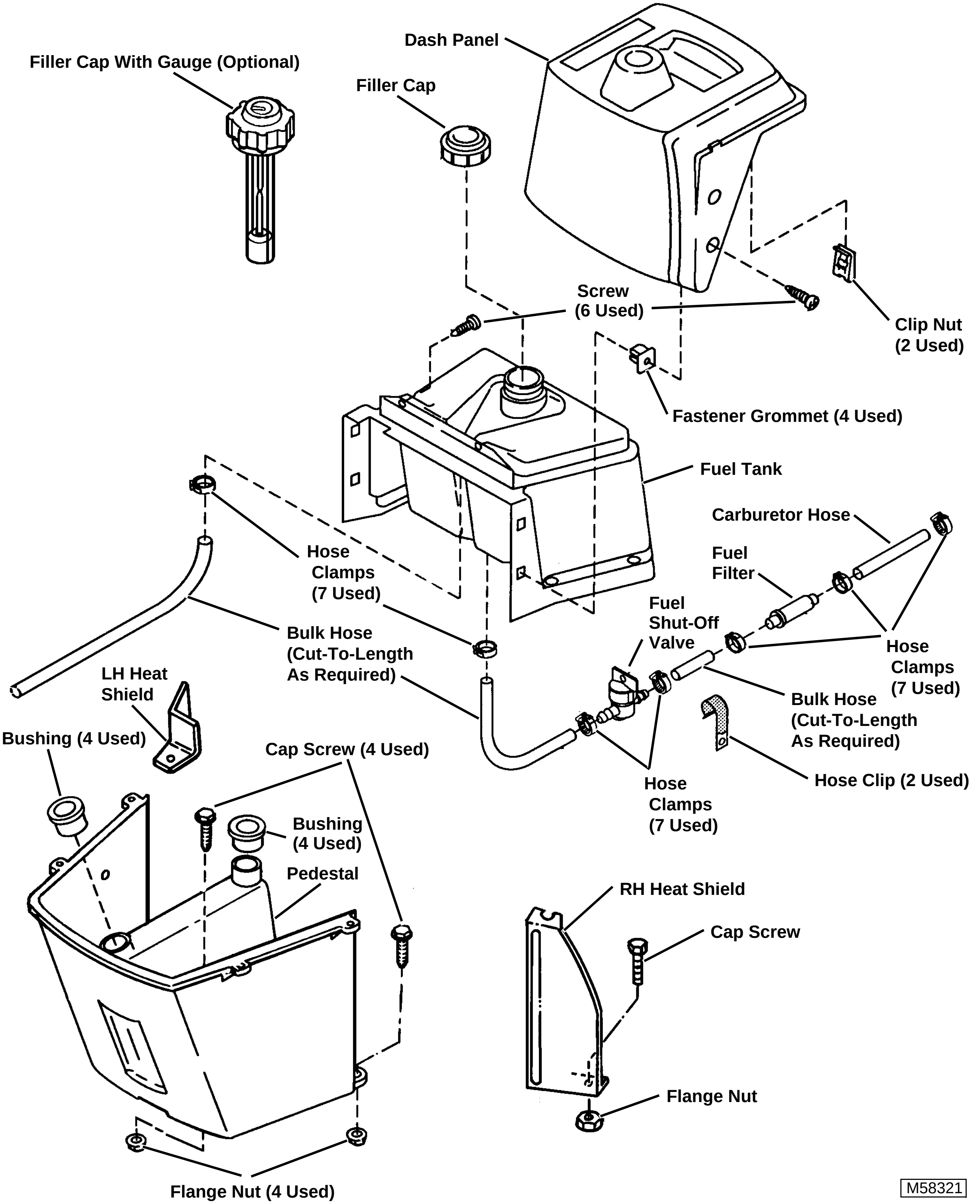
1. Attach Oil Pressure Test Hose to engine by removing plug on housing below oil filter.
2. Install test gauge on test hose.
3. Start engine and run until hot. (Be sure to maintain full crankcase oil level during testing).
4. Check oil pressure when oil is both cold and hot, and at both idle and full throttle.

Results:

- Oil pressure on a cold engine at start-up can reach as high as 414 kPa (60 psi). (Pressure relief valve will open beyond this pressure).
- Oil pressure at operating temperature (warm engine at idle) may be as low as 124 kPa (18 psi).

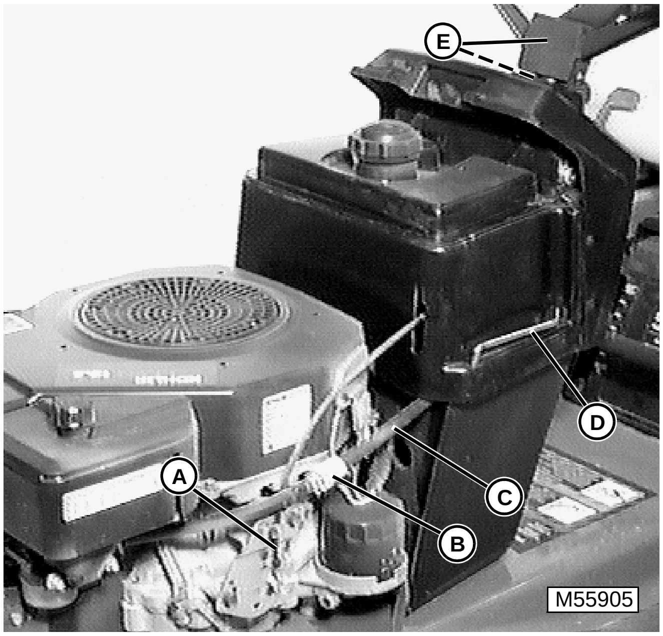
FUEL AND AIR SYSTEM REPAIR

FUEL TANK AND DASH PANEL COMPONENTS



REMOVE AND INSTALL FUEL TANK AND DASH PANEL ASSEMBLY

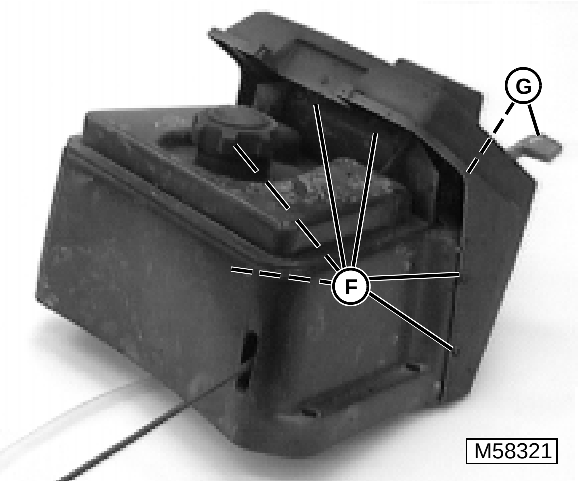
1. Disconnect battery ground (-) cable.



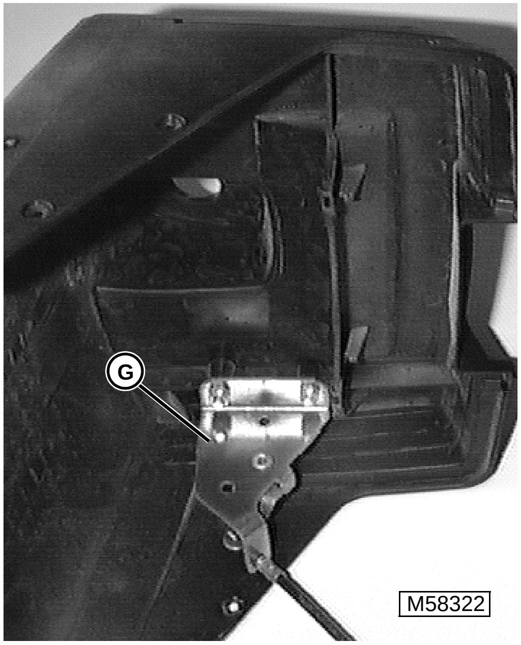
⚠ CAUTION

Gasoline is explosive. Do not expose to flame or spark. Serious injury can result. Catch or wipe up any spilled fuel immediately.

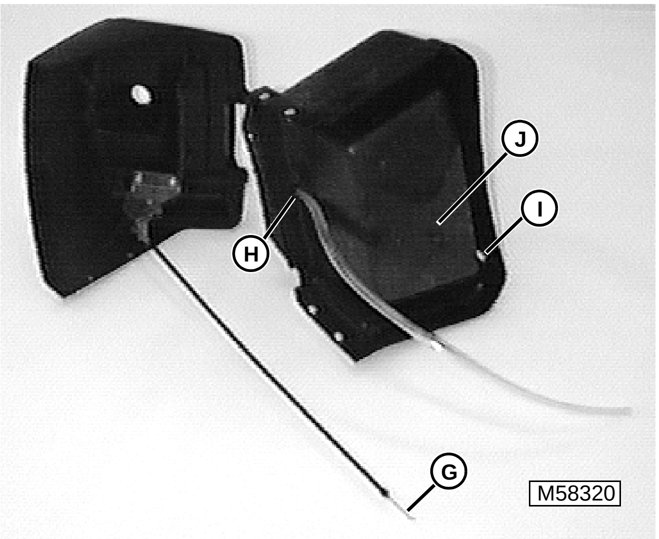
2. Squeeze fuel line (C) closed between tank and filter or turn fuel shut-off valve, if equipped, to CLOSED position.
3. Disconnect fuel line at filter (B) or filter side of fuel shut-off valve, if equipped.
4. Remove fill cap and drain any fuel into an approved container.
5. Disconnect throttle cable (A) at throttle plate.
6. Remove right and left side hood latch brackets (D).
7. Remove steering wheel and washer(s) (E).
8. Remove fuel tank/dash panel assembly to workbench.



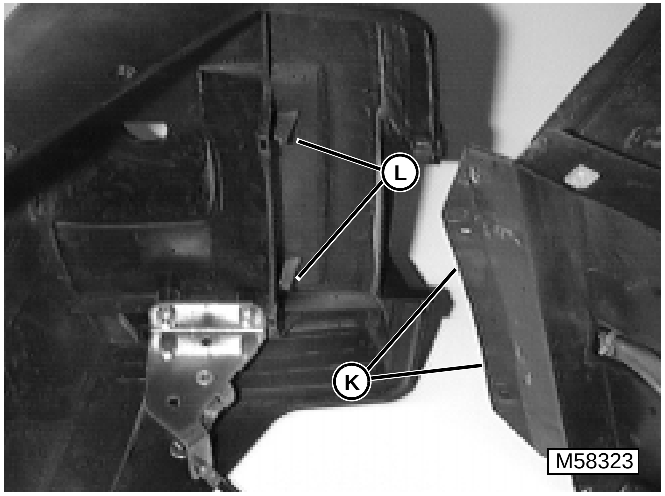
9. Remove orange tab lever from throttle cable assembly (G) only if dash panel or throttle cable assembly are to be replaced.
10. Remove six screws (F) to separate tank from dash panel and cable assembly (G).
11. Remove overflow tube and fuel line, replace as necessary.



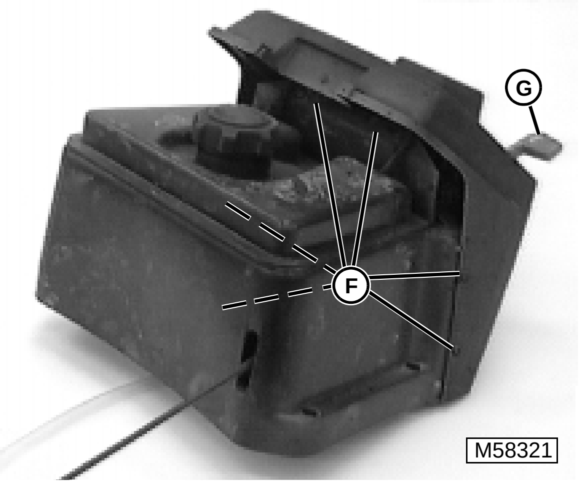
12. Remove and replace throttle cable assembly (G) as necessary.
13. Properly dispose of fuel tank and/or dash panel as necessary.



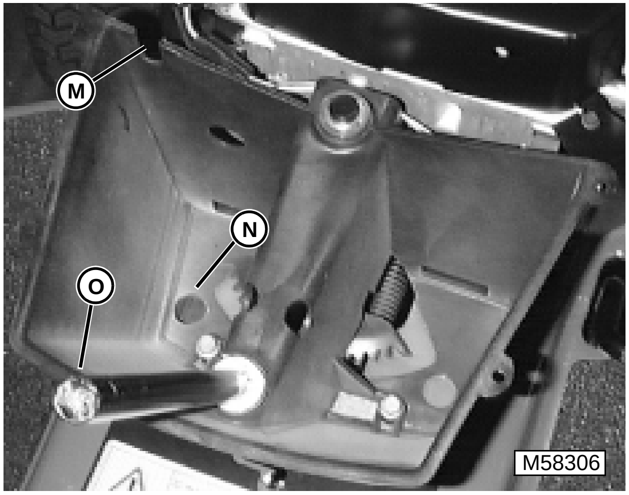
14. Install overflow tube and fuel line to fuel tank spigots (H) and (J), respectively.
15. Install end of cable assembly (G) through slot (I).



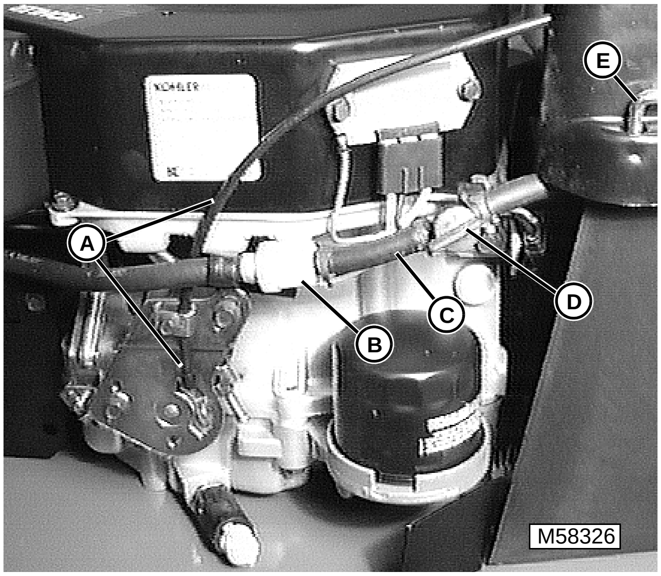
16. Install fuel tank lip (K) in console notches (L) while aligning six mounting holes.



17. Fasten fuel tank to dash panel with six screws.
18. Install orange tab lever on end of throttle lever assembly (G).



19. Align fuel hose with slot (M), over-flow tube with frame hole (N), and dash panel steering shaft hole with steering shaft (O) as you install fuel tank/dash panel assembly onto steering pedestal.



20. Install left and right side hood latch brackets (E) removed earlier.
21. Connect fuel line (C) to filter (B) or fuel shut-off valve (D), if equipped, to fuel line (C).

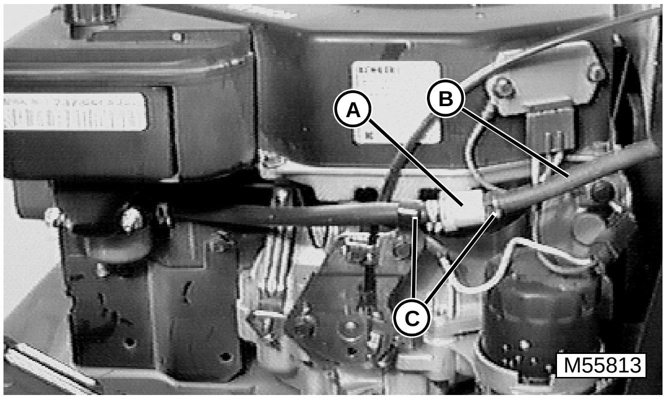
NOTE: Apply John Deere NEVER-SEEZ® lubricant to steering shaft before installing steering wheel.[1]

22. Install washer(s) exactly as removed earlier onto steering shaft.
23. Install steering wheel and fasten with cap screw and lock nut.
24. Add fuel to tank and turn fuel shut-off valve (if equipped) to ON position or release pinch device.
25. Check for and fix any leaks.

REPLACE FUEL FILTER

⚠ CAUTION

Keep cigarettes, sparks, and flames away from fuel system. Make sure engine is cool to touch.



1. Pinch fuel line (B) between tank and filter to block fuel flow or turn fuel shut-off valve, if equipped, to OFF position.
2. Slide filter clamps (C) back to disconnect hoses from filter.
3. Install new filter with arrow (A) pointing towards carburetor.
4. Clamp filter in place with two clamps (C).
5. Remove pinch device on fuel line or turn fuel shut-off valve, if equipped, to ON position.
6. Fill tank. Check for and fix any leaks.

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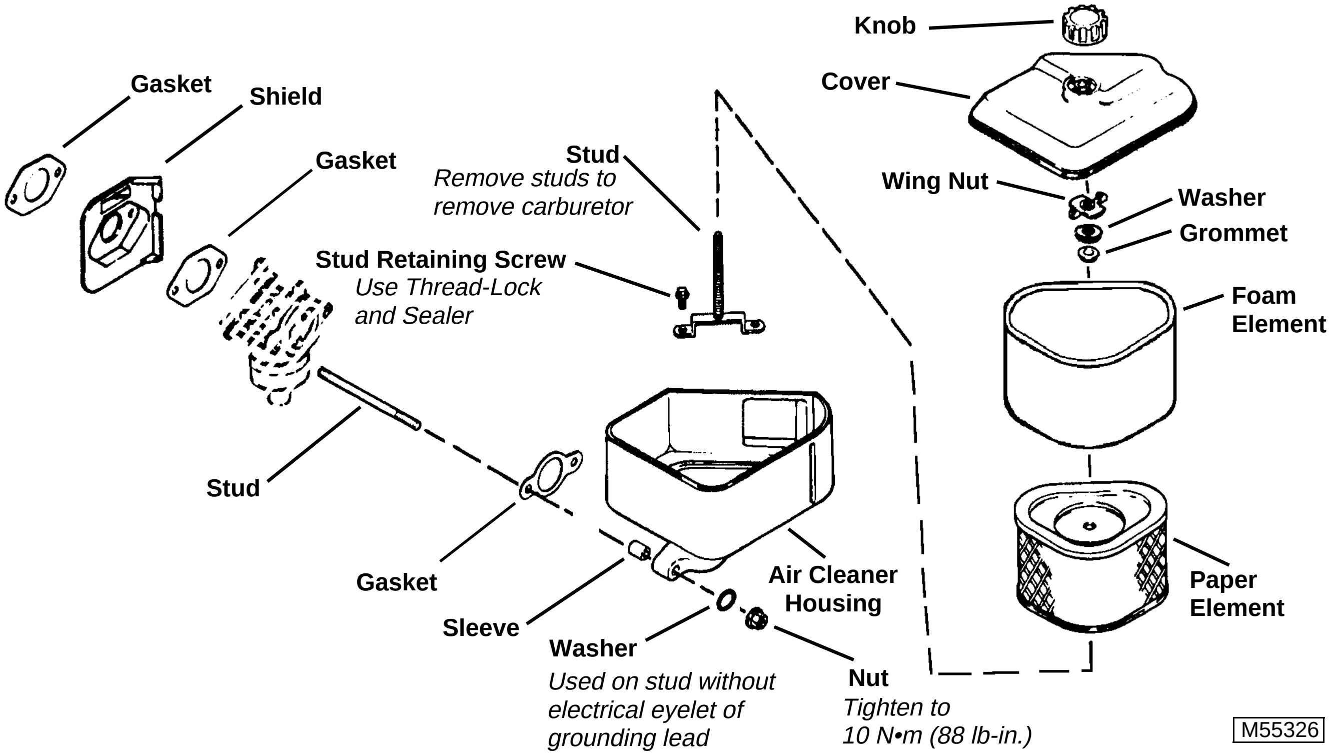
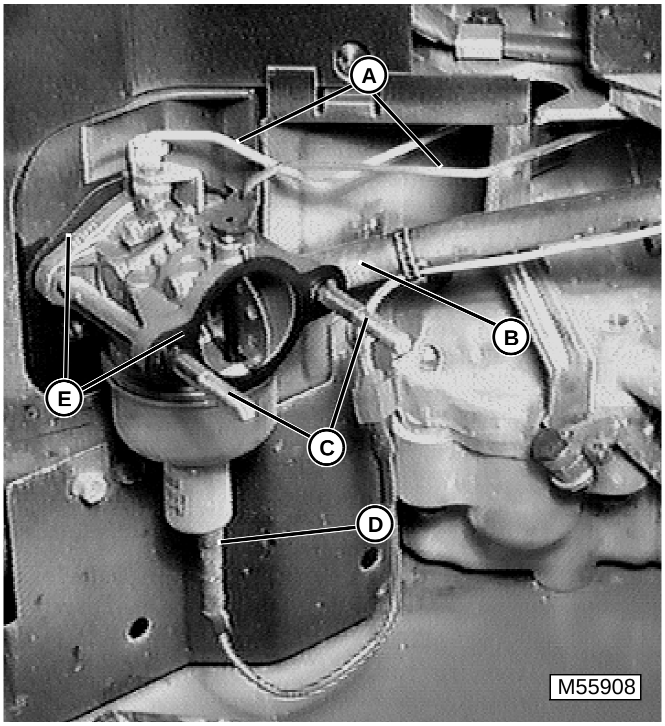
[1] NEVER-SEEZ is a trademark of the Emhart Chemical Corporation.

AIR INTAKE SYSTEM COMPONENTS



IMPORTANT: Grommet must be in place to prevent dirt ingestion. Late model tractors have outer foam air filter element (pre-cleaner) and a different cover and base design.

REMOVE AND INSTALL CARBURETOR



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⚠ CAUTION

Gasoline is explosive. Do not expose to flame or spark. Serious injury can result.

1. Turn key switch OFF and disconnect battery negative (-) ground cable.
2. Pinch fuel line (B) to block fuel flow or turn fuel shut-off valve (if equipped) to OFF position, then disconnect fuel line and solenoid wire (D) (if optional fuel shut-off solenoid is installed).
3. Remove air filter assembly (not shown) and carburetor, DO NOT damage threads of studs (C).
4. Disconnect linkage rods (A) from carburetor levers.
5. Remove and discard gaskets (E), install new ones.
6. Connect linkage rods (A) and install carburetor, studs (C), and air filter assembly.
7. Connect solenoid wire (D) (if installed), and fuel line (B)—open fuel line or turn fuel shut-off valve (if installed) to ON position.
8. Adjust carburetor, see Test and Adjustments earlier in this section.

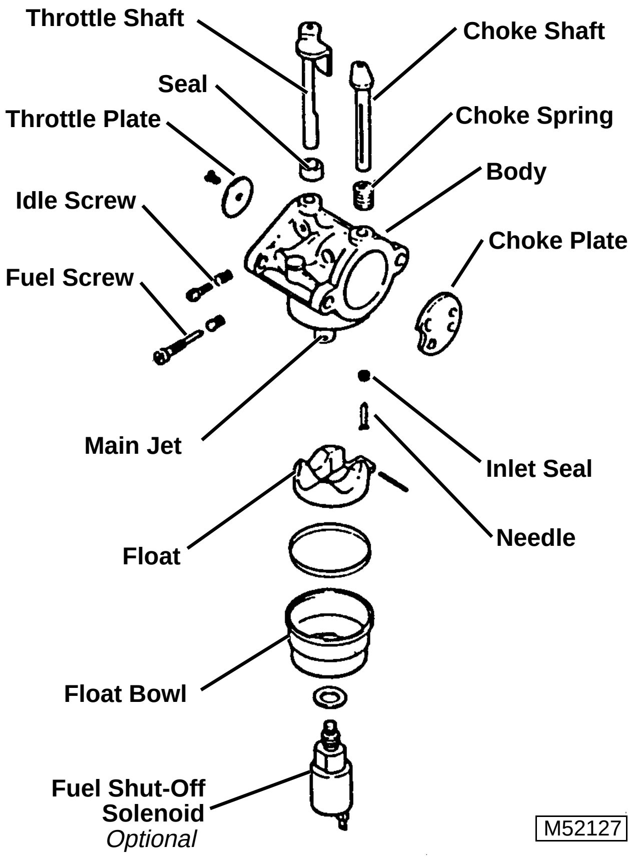
Specification:

Air Filter Assembly Nuts . . . . 10 N•m (88 lb-in.)

INSPECT CARBURETOR

⚠ CAUTION

Gasoline is explosive. Do not expose to flame or spark. Serious injury can result. DO NOT expose them to flame or spark. Follow the cleaner manufacture's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent.



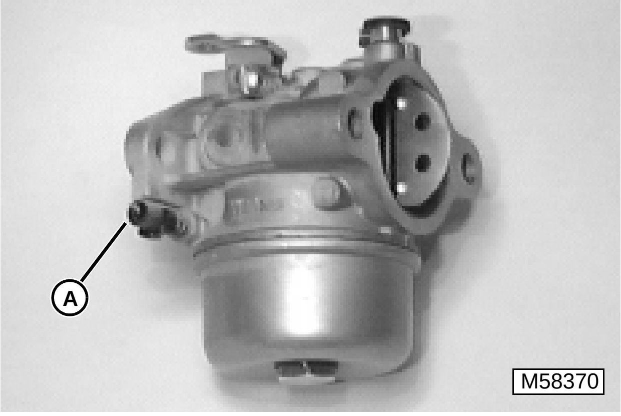
1. Disassemble bowl, float, inlet needle, low idle mixture screw and spring.

IMPORTANT: Further disassembly of carburetor is not required for general cleaning. Further disassembly will require replacing parts with new parts. DO NOT soak carburetor in carburetor cleaner when fiber, rubber or foam gaskets are still installed. Cleaner may damage these components.

2. Clean carburetor using pressurized carburetor cleaner and compressed air. Clean out all passages.
3. DO NOT remove idle port welch plug unless absolutely necessary. To remove, pierce with sharp tool. Clean chamber. Install new plug using a flat tool about the same size as plug. Flatten plug but do not force below the surface of the cavity.
4. If inlet seat was leaking or damaged it can be replaced by pulling it out with a drill bit or screw. Always replace with new parts. Press in new seat until it bottoms in bore.
5. If throttle and choke plates were removed, use a high strength thread lock and sealer on the small retaining screws. Install screws slightly loose. Apply pressure on shafts to center plates in bore, then tighten screws.

IMPORTANT: STX38 Serial Numbers (STXH271285—272591 Gear) (STXJ270811—272392 Hydro)—Float may stick in carburetor bowl due to main jet not being flush with carburetor body, this can cause fuel in crankcase and exhaust. Inspect and repair carburetor main jet as required. Removal of carburetor is not necessary. You will be able to feel the jet with your finger, or visibly see it, if it is not completely pressed in. If main jet is not completely flush, press jet flush to carburetor body using a flat blade screwdriver and pliers.

6. Main jet can be pressed out. Replace with new jet (high altitude jet is available). Press new jet in until flush with surface.
7. Low idle mixture screw has a precision taper. If screw is grooved, bent or broken this may indicate seat damage and carburetor may need to be replaced.
8. On standard carburetors, to set preliminary adjustment for idle mixture screw—**turn clockwise until LIGHTLY seated and back-out (counterclockwise) one full turn**.



CARB/EPA Carburetor

9. On CARB/EPA carburetors, no preliminary adjustment is required for idle mixture screw (A), this is pre-set by manufacturer—**only turn screw (limited to maximum 1/4 turn in either direction) until specified slow idle speed is obtained (see Slow Idle Speed Adjustment, earlier in Tests and Adjustments group of this section)**.

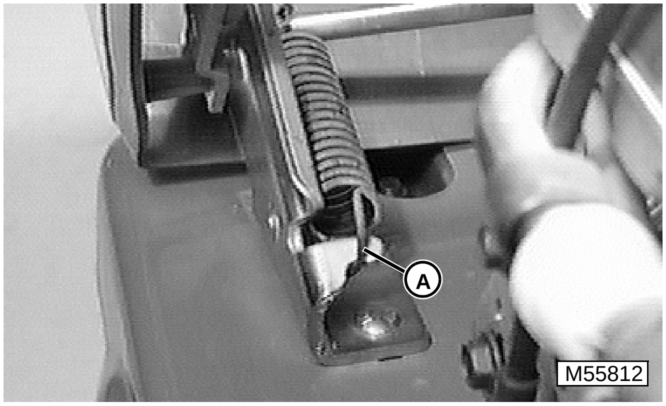
Specifications:

Carburetor Float Bowl Cap Screw . 6 N•m (55 lb-in.)

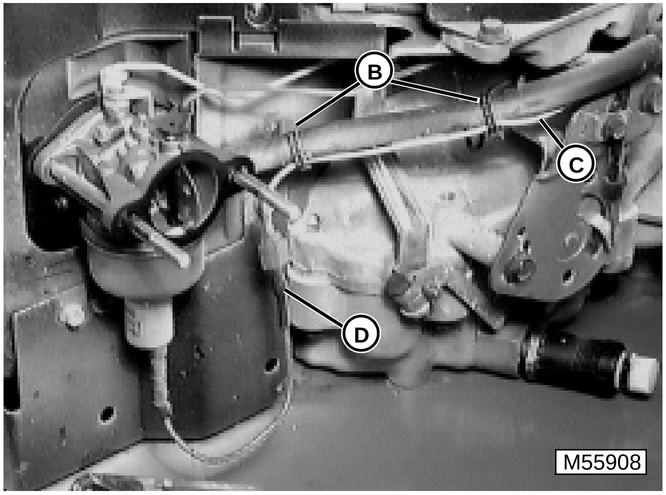
REPAIR

REMOVE AND INSTALL ENGINE

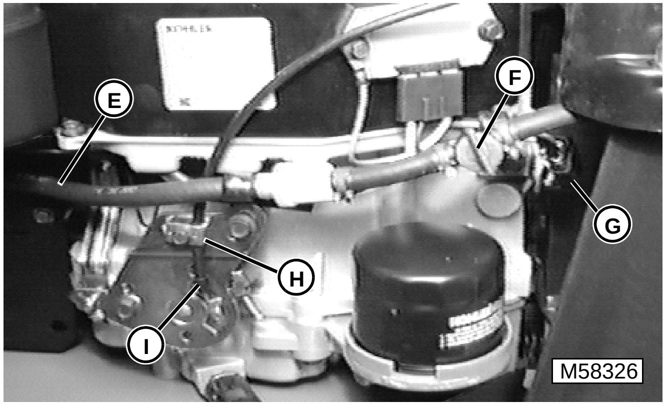
1. Turn all switches OFF and disconnect battery negative (-) cable.



2. Raise hood to disconnect springs (A) from mounting brackets on front tractor frame.
3. Lower hood and pull forward to remove.



4. Disconnect optional fuel shut-off solenoid wire (D), if installed and cut tie straps (B) to separate yellow lead (C) from engine. Air filter assembly removed for clarity purposes only.

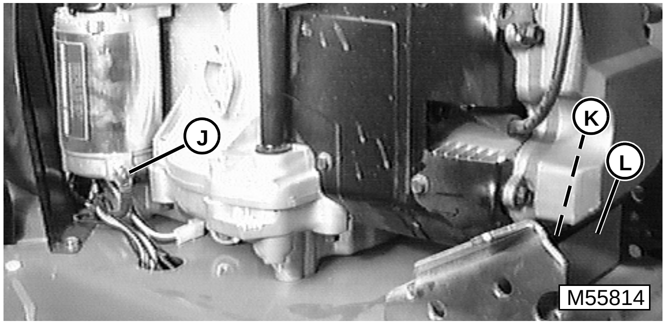


5. Turn fuel shut-off valve (F) to OFF position or pinch hose (E) close to carburetor.
6. Loosen clamp (H) to disconnect throttle cable (I).

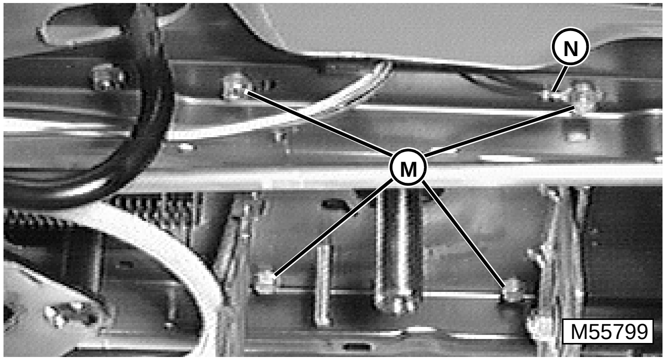
CAUTION

Gasoline is explosive. Do not expose to flame or spark. Serious injury can result. Store in a properly marked, safe container. Wipe-up any spills IMMEDIATELY.

7. Disconnect fuel line (E) at carburetor to drain fuel. Disconnect harness connector (G).



8. Disconnect wires from starter terminal (J).
9. Remove shield (L) and muffler (K).
10. Remove PTO clutch (see Remove and Install PTO Clutch in Electrical Section).



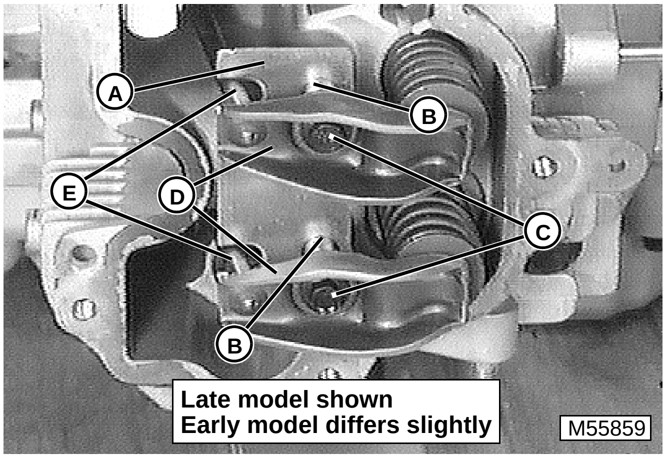
11. Remove four cap screws (M), 3 washers and disconnect ground lead (N), then remove engine.
12. Install engine and ground lead (N), as shown. Use medium strength thread lock and sealer. Tighten four cap screws (M) (use 1 washer per cap screw except ground cable cap screw) to specification.
13. Install muffler, new gasket, and shield. Tighten muffler nuts to specification.
14. Install PTO clutch (see Remove and Install PTO Clutch in Electrical Section).
15. Make all electrical wiring connections, including battery (negative cable last).
16. Connect and adjust throttle cable (see Tests and Adjustments, earlier in this section).
17. Connect fuel line and adjust carburetor (see Tests and Adjustments, earlier in this section).

Specifications:

Engine Cap Screws
. . . . 27—46 N•m (240—408 lb-in.)
Muffler Mounting Nuts . . . . **24 N•m (216 lb-in.)**

REMOVE AND INSTALL ROCKER ARMS

1. Remove valve cover.



Late model shown
Early model differs slightly

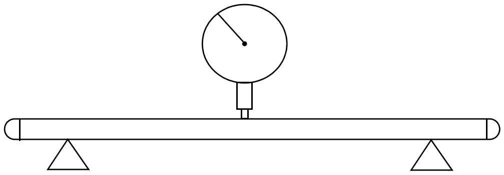
IMPORTANT: Mark push rods for assembly in original locations.

2. Remove cap screws (C) and pivot ball spacers (B).
3. Remove rocker arms (D).
4. Remove push rods (E).
5. Remove splash plate (A).
6. Inspect and replace components as necessary.
7. Install components in reverse order of removal.

Specification:

Rocker Pivot Bolts . . . . 14 N•m (124 lb-in.)

INSPECT PUSH ROD



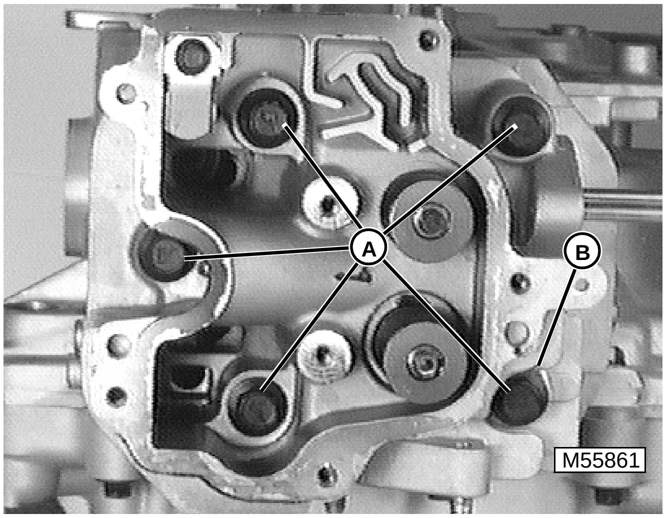
Specification:

Push Rod Bend (maximum) . . . 0.76 mm (0.030 in.)

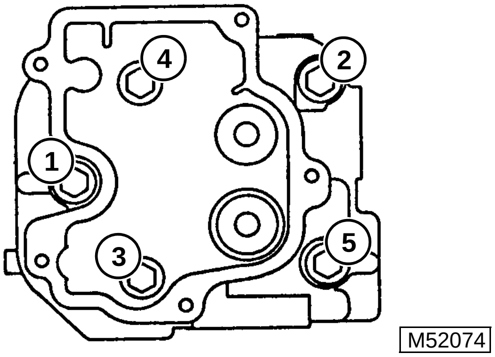
REMOVE AND INSTALL CYLINDER HEAD

IMPORTANT: Engine must be cold before removing cap screws to avoid warping aluminum cylinder head.

NOTE: Cylinder head can be serviced without removing engine from tractor.



1. Remove cap screws (A), spacer (B) and cylinder head. Discard gasket and clean head and block.
2. Install new gasket with cylinder head, cap screws and spacer.

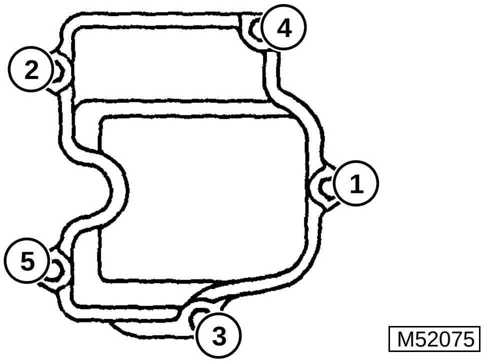


3. Torque cylinder head cap screws in 7 N•m (62 lb-in.) increments in sequence illustrated.

Specification:

Cylinder Head Cap Screws . . . . 41 N•m (30 lb-ft)

4. Install push rods and rocker arms.

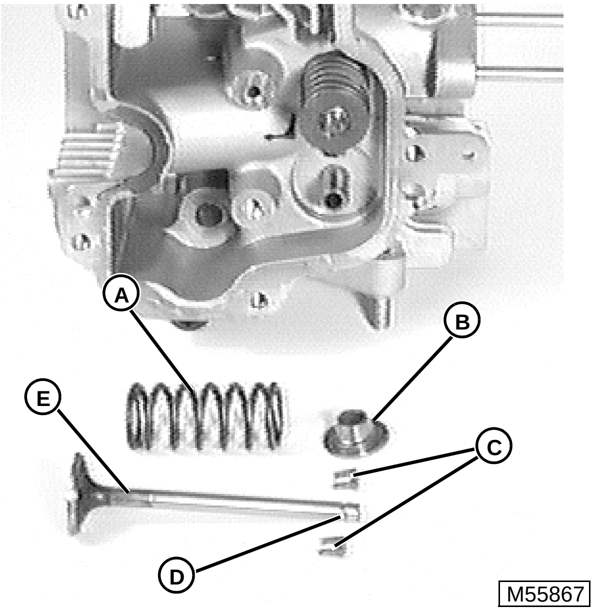


5. Clean valve cover and install using RTV silicone sealant between mating surfaces. Tighten valve cover cap screws, in sequence illustrated.

Specification:

Valve Cover Cap Screws . . . . 7.4 N•m (65 lb-in.)

REMOVE AND INSTALL VALVES AND SPRINGS



IMPORTANT: Make sure keepers are seated in valve stem groove (D).

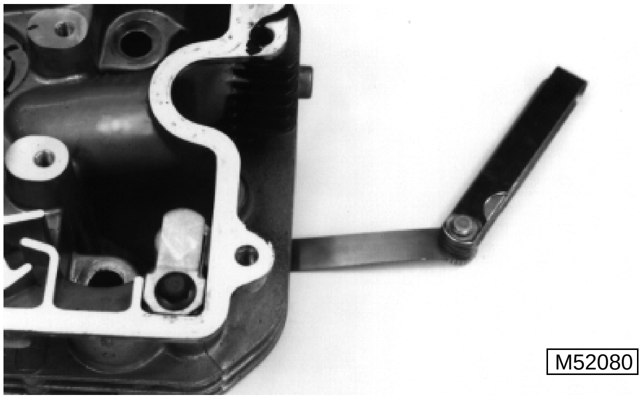
1. Compress intake and exhaust springs using an appropriate size spring compressor.
2. Remove keepers (C), spring caps (B), springs (A), and valves (E).

IMPORTANT: STX38 (SN 210000—) intake valve seal is not required.

3. Install valve components.
4. Compress spring and install keepers in grooves (D).
5. Install rocker arm assembly and cylinder head in reverse order.

INSPECT CYLINDER HEAD

1. Remove carbon deposits and clean gasket surface with SCOTCH-BRITE®[1] abrasive or equivalent.
2. Inspect head for cracks or damage. Make sure oil drain port is open.



3. Put head on a **flat** surface plate. Check for distortion at several points with a feeler gauge. Replace head if distorted beyond specification.

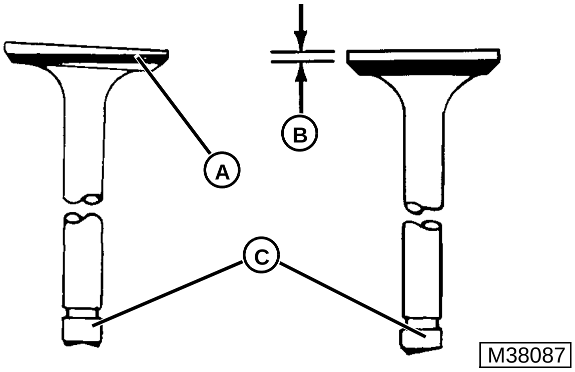
Specification:

Cylinder Head Distortion (maximum)

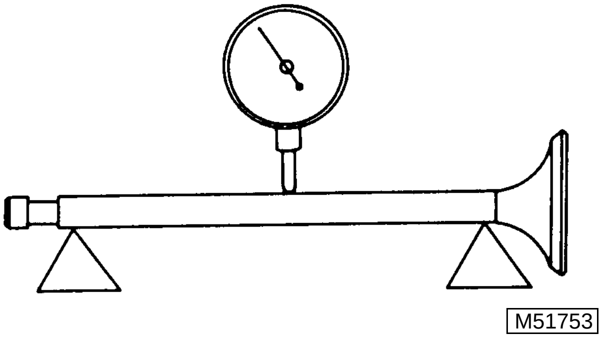
. . . . . 0.076 mm (0.003 in.)

INSPECT VALVES

1. Remove carbon from valve head, face, and stem.
2. Check valve for cracks or damage.



3. Replace warped valves (A) or valves with less than serviceable margin (B). Valve stem ends (C) should be square, not worn uneven as shown.



4. Inspect valve stems for bends using V-blocks and dial indicator. Turn valve slowly and read variation. Replace if variation is greater than specification.

Specification:

Valve Stem Bend (maximum)

. . . . . 0.076 mm (0.003 in.)

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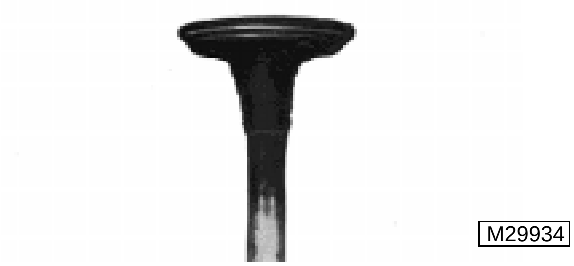
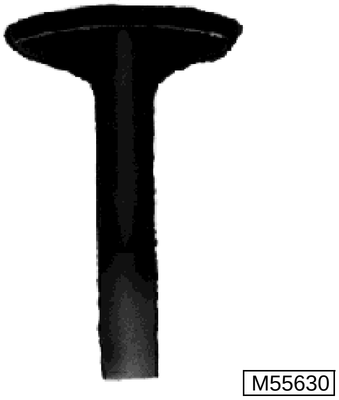
[1] SCOTCH-BRITE is a registered trademark of the 3M Company.

ANALYZE VALVES


M29934

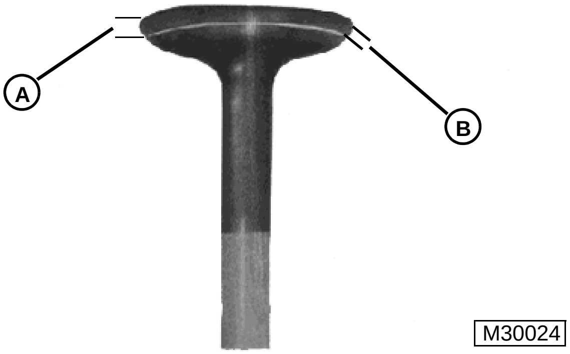
Lead deposits on the intake valve are caused by exhaust gas leakage past the valve when using leaded gasoline. Grind intake valve and reface valve seat to correct this condition.

Use unleaded fuel to prevent lead deposits.


M55630

Valve stem corrosion is caused by moisture in the engine which occurs during hot engine cool-down periods or during storage.

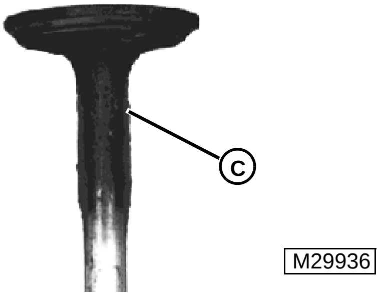
Fogging of combustion chamber with oil before storage helps prevent corrosion. Replace badly corroded valves.



M30024

Operating at high temperatures for long periods of time can cause exhaust valve burning. Burned valve will show dark discoloration into the area protected by the valve guide. Another indication is distortion of the margin (A) and face angle (B). The valve seat may also show erosion.

An overheated engine can also cause valve burning. Check for clogged engine cooling fins. Do not run engine with blower housing removed. Also check for worn valve guides, springs or hydraulic lifters, lean fuel-air mixture, or incorrect spark plug.



M29936

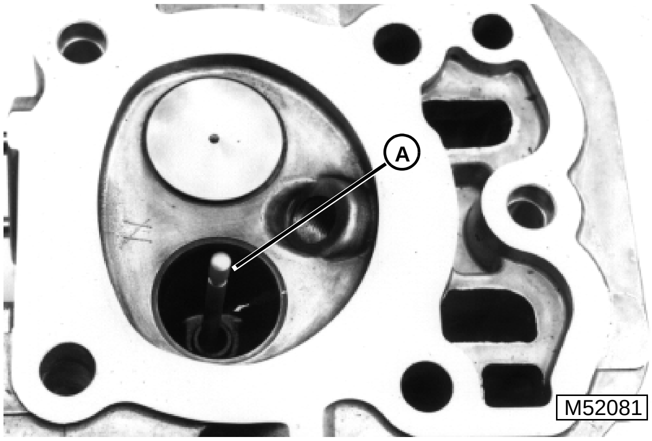
Use of old or stale gasoline can cause valves to stick.

Gummy deposits (C) can build up on valve and can also gum carburetor, requiring cleaning.

Always use fresh gasoline of 87 octane rating or higher. Drain fuel tank, lines, and carburetor before storage.

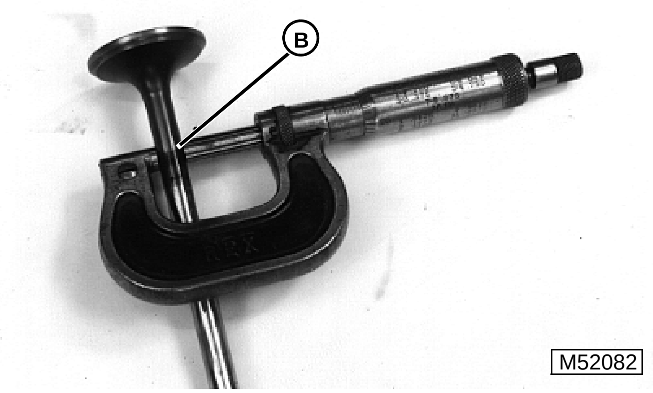
INSPECT VALVE GUIDES

1. Clean inside of valve guide. Standard valve guide reamer (D20020WI) can be used.



M52081

2. Measure inside diameter of guide with gauge (A).



M52082

3. Measure outside diameter of valve stem (B).
4. An oversize valve is available. Replace valve if stem-to-guide clearance is too great.

IMPORTANT: If guide is reamed oversized, an oversize valve must be installed.

5. Use oversize reaming tool (JDG705) to ream guide, if necessary.
6. Replace cylinder head if inside diameter of guide is greater than oversize specification.

Specifications:

Valve Guide Ream (standard)

. . . . . 7.048 mm (0.2775 in.)

Valve Guide Ream (oversize)

. . . . . 7.298 mm (0.2873 in.)

Intake Stem-to-Guide Clearance

. . . . 0.38—0.076 mm (0.0015—0.0030 in.)

Intake Guide (Maximum Wear)

. . . . . 7.134 mm (0.2809 in.)

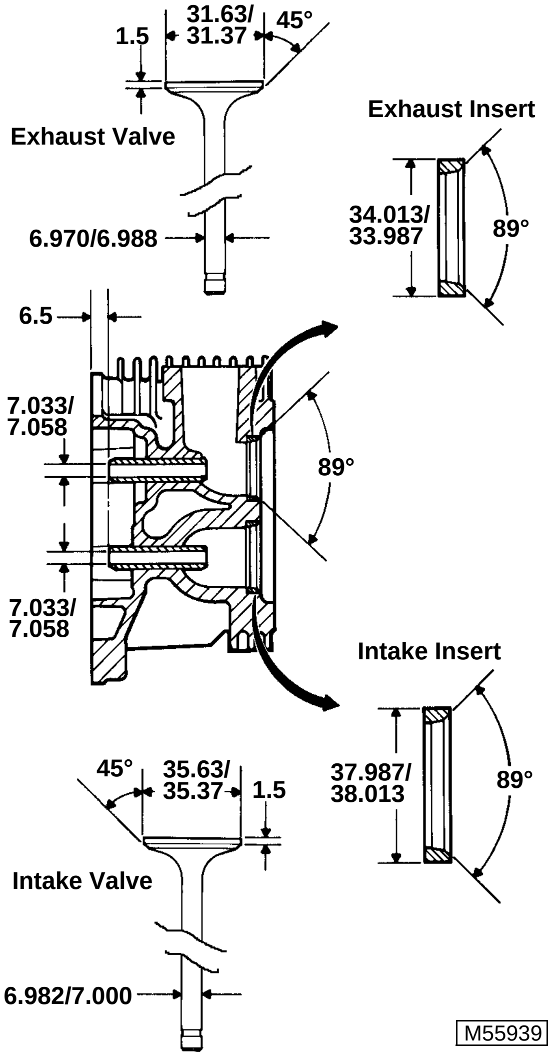
Exhaust Stem-to-Guide Clearance

. . . . 0.050—0.088 mm (0.002—0.0035 in.)

Exhaust Guide (Maximum Wear)

. . . . . 7.159 mm (0.2819 in.)

RECONDITION VALVE SEATS

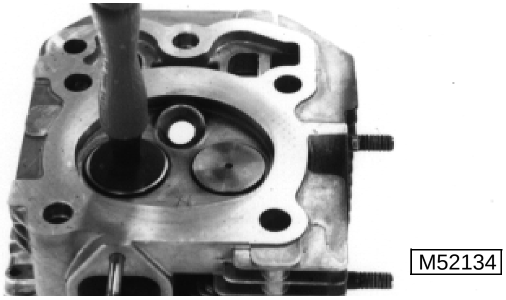


M55939

1. Inspect valve seats.
2. Replace cylinder head if seats are warped or distorted beyond reconditioning.
3. Reface pitted or worn seats as shown in drawing.
4. Lap valves after refacing
5. Check seat for good contact using Prussian Blue Compound.

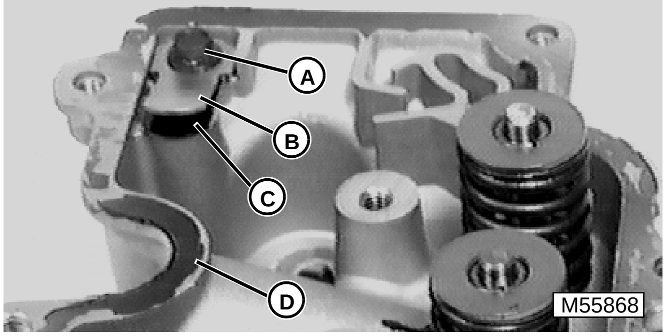
LAP VALVES

IMPORTANT: Valves and seats should be lapped if they do not make good contact.



1. Apply light coat of lapping compound to valve face, then turn valve in seat using vacuum cup tool.
2. Check valve every 8 strokes until a uniform ring appears around surface of valve face.
3. Wash parts in solvent to remove lapping compound.
4. Check position of lap mark on face–lap mark must be on or near center of valve face.

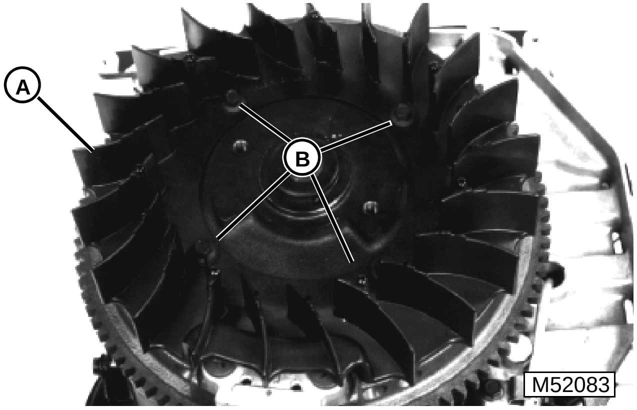
INSPECT BREATHER



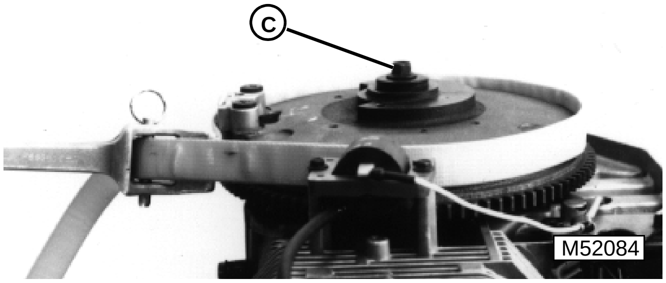
1. Remove cap screw (A), plate (B), and reed (C).
2. Check that breather opening is clear.
3. Replace reed if it does not lie flat on casting.
4. Clean mating surface of any sealant residue (D).

REMOVE AND INSTALL FLYWHEEL

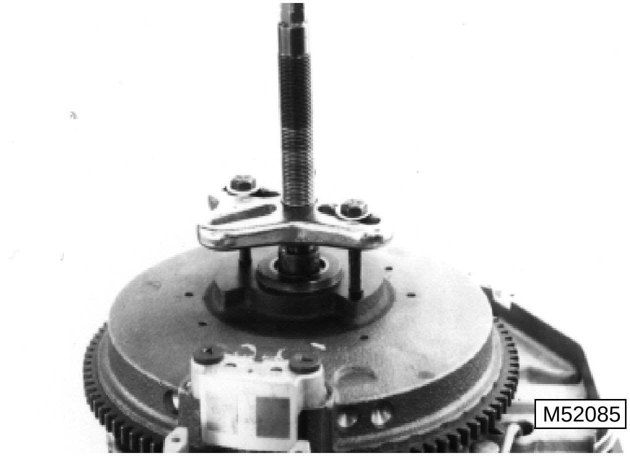
1. Remove blower housing sheet metal.



2. Remove four fan cap screws and washers (B) and fan (A



3. Hold flywheel with strap wrench. Remove cap screw (C).



4. Remove flywheel using a puller.

NOTE: Flywheel and magnets are not serviceable.

5. Inspect flywheel for cracks, chips, and broken teeth. Replace as necessary.
6. Inspect for sheared or partially sheared key, replace as necessary.

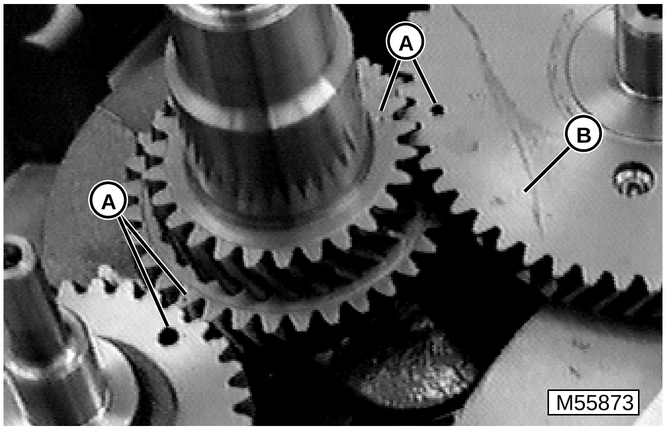
IMPORTANT: Check that crankshaft end and flywheel hub are clean and free of lubricant, and flywheel key is installed properly in keyway. Improperly installed flywheel can cause machine damage and serious personal injury.

7. Install flywheel and key on crankshaft.
8. Hold flywheel with strap wrench. Tighten cap screw (A) to specification.
9. Check ignition module air gap (see Adjust Ignition Module Air Gap, in the Tests and Adjustments Group of the Electrical Section).

Specification:

Flywheel Cap Screw. . . . . 68 N•m (50 lb-ft).

REMOVE AND INSTALL CAMSHAFT

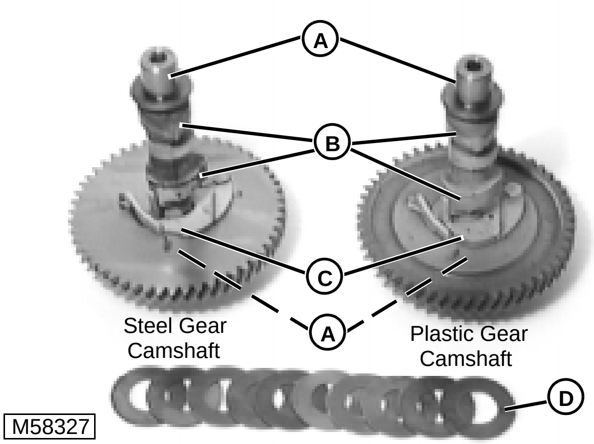


1. Rotate crankshaft to align two sets of marks (A).
2. Remove camshaft (B).
3. Inspect camshaft closely, replace as necessary.
4. Coat entire camshaft with engine oil.
5. Install camshaft with four timing marks (A) aligned.
6. Check camshaft end play.
7. If not within specification, use appropriate shims from Camshaft Shim Kit (D), shown below in photo M58327.
8. Align flat surface of balancer shaft with bore flat of oil pump inner rotor gear as you install oil pan.
9. Install push rods, rocker arm assembly, and valve cover, see those procedures earlier in this section.

Specification:

Camshaft End Play
. . . . 0.076–0.127 mm (0.003–0.005 in.)

INSPECT CAMSHAFT

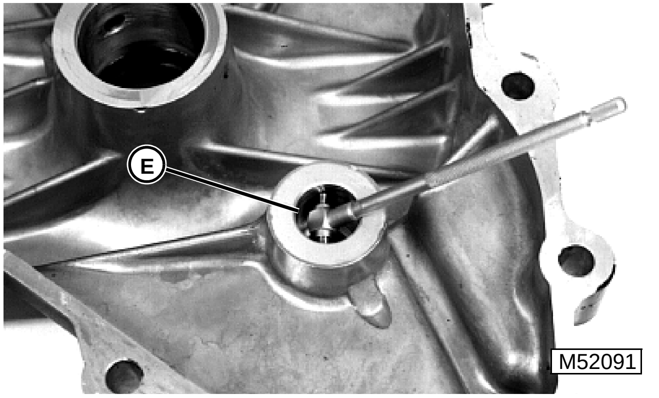


1. Inspect camshaft for worn or broken teeth.
2. Measure journals (A). Replace camshaft if measurements do not meet specifications.

Camshaft Journal Specification:

O.D. (New)
. . . . 19.962—19.975 mm (0.7859—0.7864 in.)
O.D. (Max. Wear Limit) . . . . . 19.959 mm (0.7858 in.)

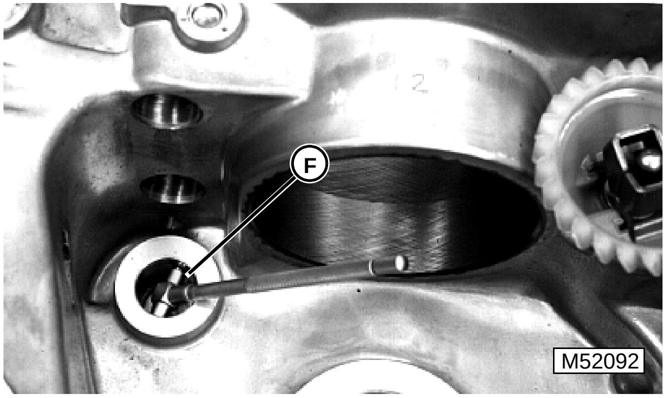
3. Inspect lobes (B). Replace camshaft if lobes show excessive wear.
4. Inspect ACR mechanism (C). Replace spring if necessary and check that weight moves freely.



5. Measure camshaft bore (E) in oil pan.
6. Subtract journal OD. from bore ID. to determine clearance with camshaft journal. Replace if not within specifications.

Camshaft Bearing Bore Specification:

Oil Pan Camshaft Bore
(New) . . . . . 20.000—20.025 mm (0.7874—0.7844 in.)
(Max. Wear Limit) . . . . 20.038 mm (0.7889 in.)
Camshaft to Bore
Clearance . . . 0.025—0.063 mm (0.0010—0.0025 in.)



7. Measure camshaft bore (F) in crankcase.
8. Subtract journal OD. from bore ID. to determine clearance with camshaft journal. Replace if not within specification.

Camshaft Bearing Bore Specification:

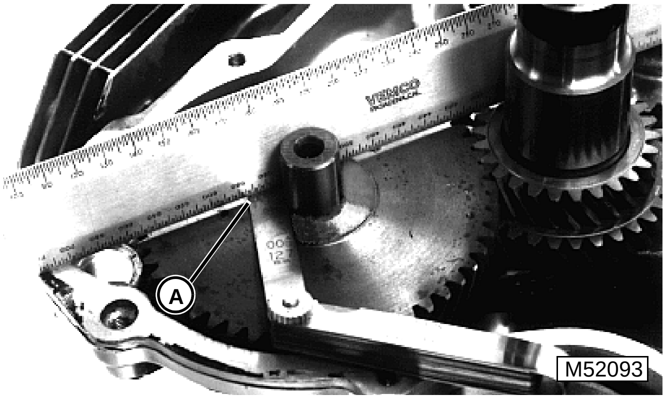
Crankcase Camshaft Bore
(New) . . . . . 20.000—20.025 mm (0.7874—0.7844 in.)
(Max. Wear Limit) . . . . 20.038 mm (0.7889 in.)

Camshaft to Bore

Clearance . . . 0.025—0.063 mm (0.0010—0.0025 in.)

MEASURE CAMSHAFT END PLAY

1. Check that camshaft is seated in crankcase bore.



2. Measure play (A) between camshaft and straight edge (spanning crankcase) using flat feeler gauge.
3. Use shims from Shim Kit as necessary until end play is within specification.

Camshaft End Play Specification (with shims):

(Maximum) . . . . 0.076—0.127 mm(0.003—0.005 in.)

Shim Thickness Range:

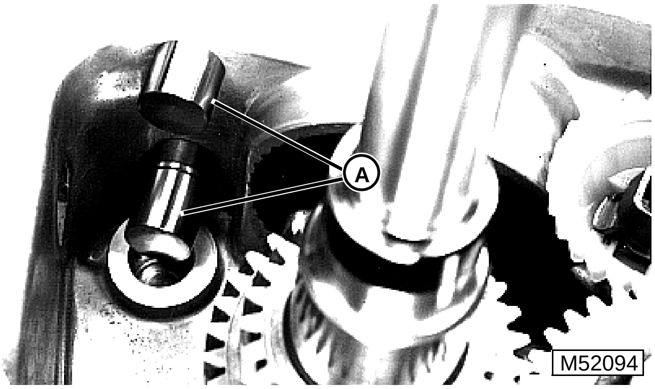
The most commonly used shims are listed below. Additional shims are available through the parts catalogue.

. . . . . 0.73 mm (0.29 in.)
. . . . . 0.75 mm (0.30 in.)
. . . . . 0.81 mm (0.32 in.)
. . . . . 0.86 mm (0.34 in.)

HYDRAULIC VALVE LIFTERS—REMOVE AND INSTALL

1. Remove camshaft.

IMPORTANT: Used lifters are mated to their camshaft lobes. Mark them for installation in the correct bore.



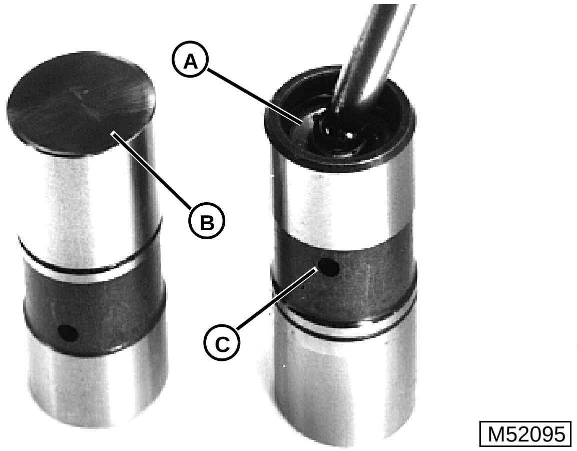
2. Remove lifters (A).
3. Inspect lifters for wear, replace as necessary.
4. Coat lifters with engine oil and install in correct bore.
5. Install camshaft.

HYDRAULIC VALVE LIFTERS—INSPECTION

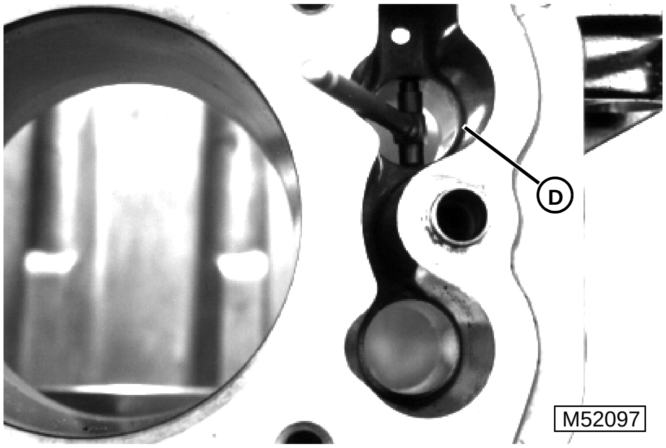
Reasons:

- If lifter noise continues after 20 minutes of running, it is probably an indication of contamination or dirt in the lifter preventing the check ball from seating. Replace lifter.
- A lifter which suddenly gets noisy while engine is running would probably be caused by trapped. If noise is caused by contamination, replace lifter. If noise is caused by trapped air, see Step 2 under “Lifter Noise After Start-Up”.
- Lifter noise which appears or worsens as the engine heats up is usually due to wear in the lifters and other engine components, especially if engine has considerable running hours or has not had regular oil changes. Replaces lifters and other internal engine components that do not meet wear limit specifications.
- A situation where the lifter seems to pump up too much, holds a valve open, causes loss of compression or hard starting, indicates insufficient clearance between the plunger and body. Replace lifter.

IMPORTANT: Damaged or worn lifters usually indicate a damaged camshaft. Check camshaft before replacing lifters.



1. Inspect lifter face (B) for wear. Face should be flat and smooth.
2. Use push rod to depress plunger (A). Plunger should offer resistance but move smoothly.
3. Check that oil hole (C) is clear to inner piston.
4. Measure outside diameter of lifter.



5. Measure inside diameter of crankcase lifter bore (D).
6. Subtract lifter OD. from bore ID. to determine if clearance is not within specification.

IMPORTANT: Make sure lifters are “PRIMED” before installation and “BLED” before start up to prevent damage to push rods or rocker arms. See priming and bleeding procedure on page 3-41.

7. Replace lifters that are worn or damaged. Replace components as necessary.

Specification:

Valve Lifter To Bore Clearance (maximum)
. . . . 0.0124—0.0501 mm (0.0005—0.0020 in.)

Priming Procedure For Hydraulic Lifters

1. Place lifter in small container.
2. Pour 10W30 oil into container until oil is level with top of lifter.
3. Place the end of one of the push rods into the socket on top of the lifter and “pump” the lifter with push rod until it feels solid.
4. Remove lifter from oil, let it drip off for a moment, and install into appropriate bore in engine.

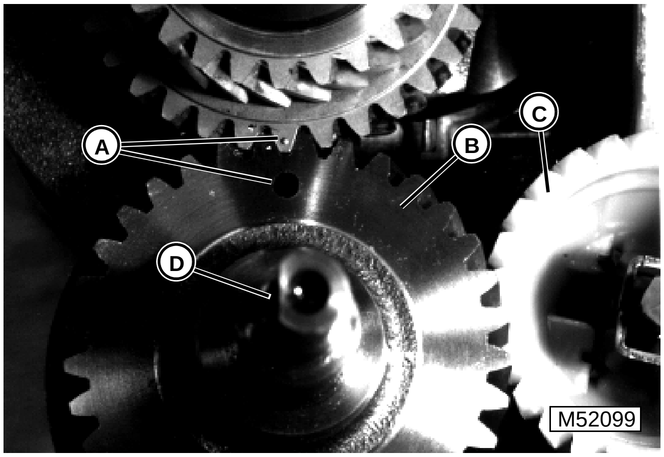
Bleed Procedure For Hydraulic Lifters

1. After installing cylinder head, rotate flywheel so piston is at TDC (top-dead-center) between the exhaust and intake strokes. At TDC, the rocker arms will move alternately if the flywheel is rocked. This allows for maximum pressure on the lifters.
2. Leave engine in this position and re-assemble remaining engine parts.
3. After engine has been in this position for 10 minutes (can include assembly time) turn engine over slowly by hand.
4. If engine turns over completely, fill the crankcase to proper level with recommended oil and test run.
5. If engine does not turn over completely (locks up at some point), stop turning at the point of lockup and allow 10 more minutes for the lifters to bleed down. Then try rotating by hand again.

Results

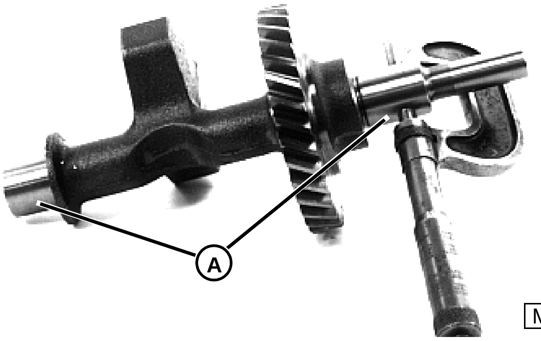
- Lifter noise immediately after start-up is usually due to contraction and/or leakdown. There will be some noise when engine is first started but should last only a few seconds, but no more than a few minutes.
- If lifter is still noisy after 5 minutes of running, air could be trapped in the lifter. Stop engine and check oil level. Adjust as necessary and run engine for an additional 20 minutes at half throttle.

BALANCER SHAFT REMOVAL & INSTALLATION



1. Align marks (A) on balancer shaft and crankshaft.
2. Remove balancer shaft (B).
3. Inspect balancer shaft, replace as necessary.
4. Align marks (A) and install balancer shaft (B) so it also aligns with governor gear (C).
5. Remember, when installing oil pan, be sure to align flat (D) of balancer shaft with bore flat of oil pump inner rotor gear.

BALANCER SHAFT INSPECTION



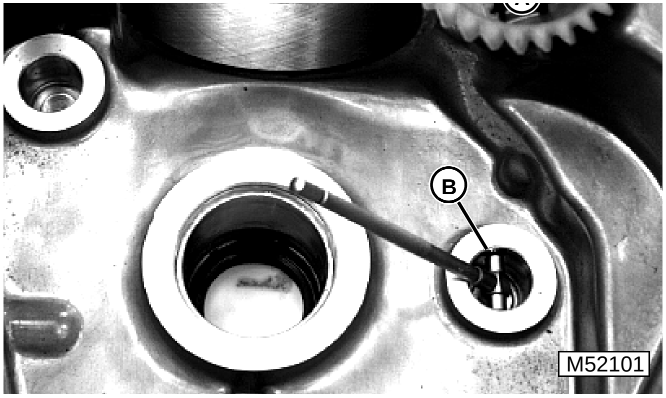
M52100

1. Inspect shaft for cracks and broken teeth. Replace shaft if cracked or damaged.
2. Measure journals (A). Replace if not within specification.

Balancer Shaft Journal O. D. Specification

New . . . . . . 19.962—19.975 mm (0.7859—0.7864 in.)

Wear Limit. . . . . 19.959 mm (0.7858 in.)



M52101

3. Measure balancer shaft bore (B) in crankcase.
4. Subtract journal OD. from bore ID. to determine clearance with balancer shaft journal. Replace crankcase if measurements are not within specifications.

Balancer Shaft Crankcase Bore Specifications:

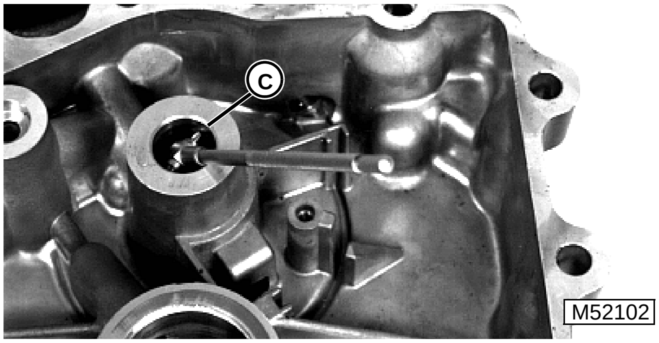
ID (New)

. . . . 20.000—20.025 mm (0.7874—0.7884 in.)

Wear Limit. . . . . 19.959 mm (0.7858 in.)

Balancer Shaft to Crankcase Bore Clearance

. . . . 0.025—0.063 mm (0.0009—0.0025 in.)



M52102

5. Measure balancer shaft bore (C) in oil pan.
6. Determine clearance with balancer shaft journal. Replace oil pan if measurements not within specifications.

Balancer Shaft Oil Pan Bore Specifications:

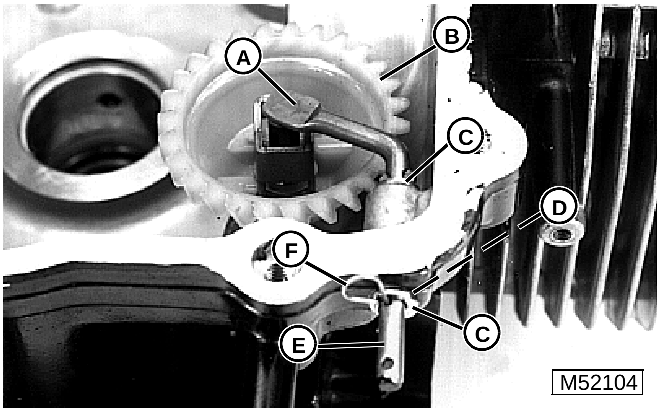
ID (New). . . 20.000—20.025 mm (0.7874—0.7884 in.)

Wear Limit. . . . . 19.959 mm (0.7858 in.)

Balancer Shaft to Crankcase Bore Clearance

. . . . 0.025—0.063 mm (0.0009—0.0025 in.)

GOVERNOR REMOVAL & INSTALLATION



M52104

1. Remove governor lever (not shown) from end of control arm (E).
2. Remove spring clip (F), washers (C), and governor control arm (A) from inside of crankcase.
3. Remove and discard seal (D).

NOTE: *Check governor shaft/gear assembly, if plastic gear, flyweight assembly, flyweight cap, and/or shaft are damaged, the complete assembly must be replaced.*

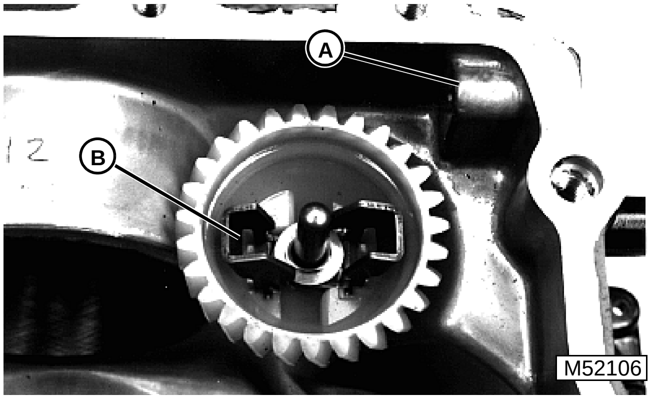
4. Inspect governor shaft/gear assembly (B), replace as necessary (see Replace Governor Shaft/Gear Assembly, later in this group).
5. Install governor shaft/gear assembly.
6. Install new seal (D) using suitable driver.
7. Install control arm, washers, and clip.
8. Install lever (not shown).

GOVERNOR INSPECTION

1. Measure outside diameter of control arm shaft. Replace if not within specification.

Governor Control Arm Specifications:

O.D. (New). . . 5.975—6.000 mm (0.2352—0.2362 in.)
Wear Limit. . . . . 5.962 mm (0.2347 in.)



2. Measure inside diameter of crankcase bore (A).

Governor Control Arm Crankcase Bore Specs:

I.D. (New). . . . 6.025—6.050 mm (0.2372—0.2382 in.)
Wear Limit. . . . . 6.063 mm (0.2387 in.)

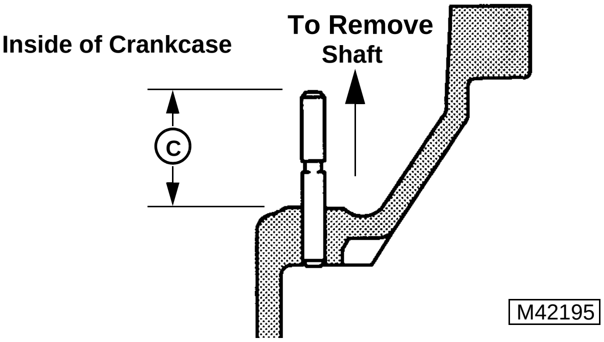
3. Determine governor control arm shaft-to- bore clearance. Replace governor shaft/gear assembly as necessary.

Governor Control Arm-to-Crankcase Bore Specs:

Clearance . . . 0.025—0.075 mm (0.0010—0.0030 in.)

4. Inspect flyweights (B) for proper operation and free movement. Replace governor shaft/gear assembly as necessary.

IMPORTANT: DO NOT remove governor shaft with vise-grips or pliers, damage to case may result.



5. With a small punch, CAREFULLY drive governor shaft toward inside of crankcase to remove it.
6. From inside of crankcase, install new governor shaft/gear assembly by pressing or lightly tapping shaft into crankcase bore to specified height (C).

Governor Gear Shaft Specifications:

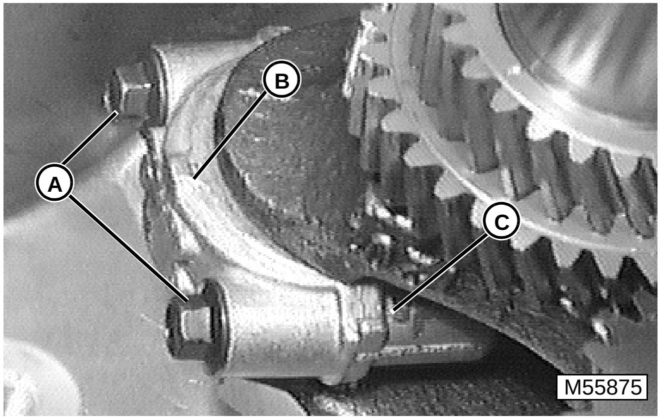
Height (C)
. . . . 32.639—32.842 mm (1.285—1.293 in.)
Diameter (New)
. . . . 5.990—6.000 mm (0.2358—0.2362 in.
Diameter (Wear Limit)
. . . . . 5.977mm (0.2353 in.)

REMOVE PISTON ASSEMBLY

1. Remove balance shaft, and camshaft.

IMPORTANT: Remove carbon ridge, if present, from cylinder before removing piston.

2. Remove carbon ridge, if present at top of cylinder, using a ridge reamer.

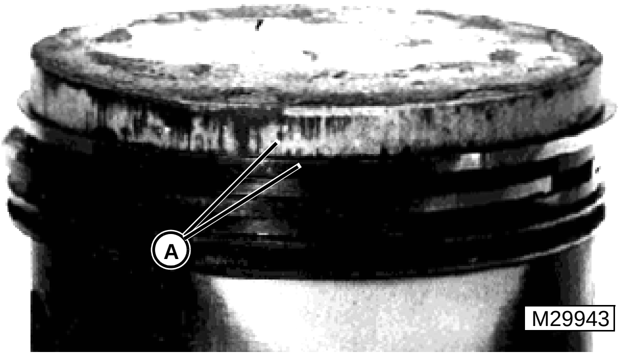


3. Remove cap screws (A) to remove cap (B) from connecting rod (C).
4. Remove piston assembly through top of cylinder.
5. Inspect piston assembly, see following two topics.

ANALYZE PISTON RING WEAR

Rings of the wrong size or rings having improper end gap will not conform to the shape of the cylinder. This results in high oil consumption and excessive blowby.

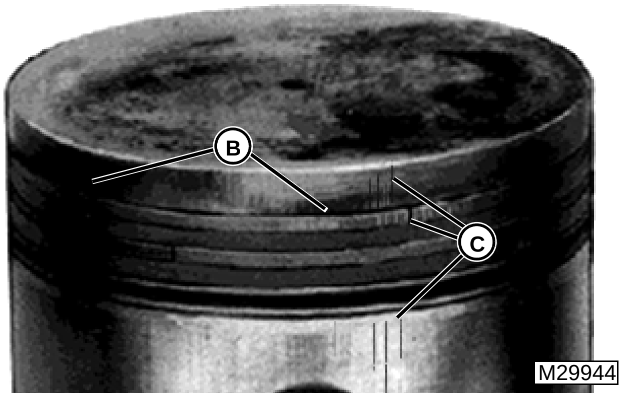
Ring end gaps should be staggered on the piston during installation. End gaps in alignment can also cause oil consumption and blowby.



Light scuffing or scoring (A) of both rings and piston occurs when unusually high friction and combustion temperatures approach the melting point of the piston material.

When this condition exists, it is due to one or more of the following probable causes:

1. Dirty cooling shroud and cylinder head.
2. Lack of cylinder lubrication.
3. Improper combustion.
4. Wrong bearing or piston clearance.
5. Too much oil in crankcase causing fluid friction.



The engine operating at abnormally high temperatures may cause varnish, lacquer, or carbon deposits (B) to form in the piston grooves making the rings stick. When this happens, excessive oil consumption and blowby will occur.

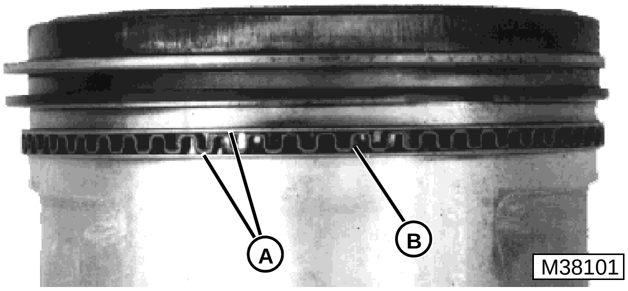
Engine overheating and ring sticking is usually caused by one or more of the following:

1. Overloading.
2. Incorrect ignition timing.
3. Lean fuel mixture.
4. Dirty cooling fins.
5. Incorrect oil.
6. Low oil supply.
7. Stale fuel.

Vertical scratches (C) across the piston and rings are due to an abrasive in the engine. Abrasives may be airborne, may have been left in the engine during overhaul or may be loose lead and carbon deposits.

When this condition exists, check for one or more of the following:

1. Damaged, collapsed, or improperly installed air filter.
2. Loose connection or damaged gasket between air cleaner and carburetor.
3. Air leak around carburetor-to-cylinder block gasket.
4. Air leakage around throttle shaft.
5. Failure to properly clean cylinder bore after reconditioning engine.

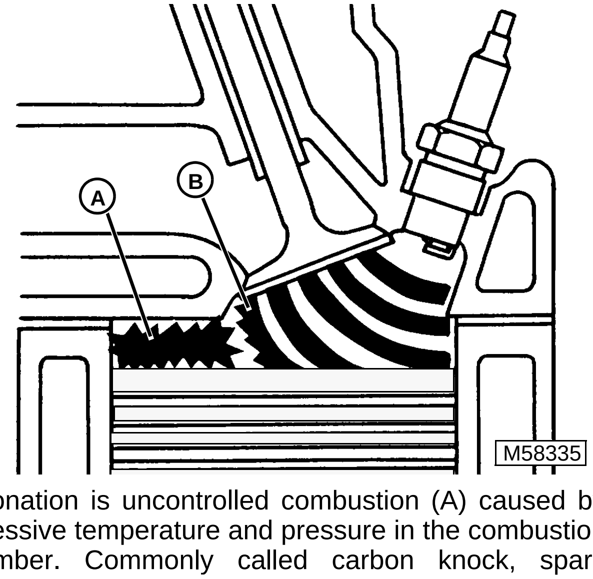


Abrasive particles in engine oil cause scratches on side rails (A) of oil control ring. If inner spacer (B) of oil control ring is worn or distorted it may cause:

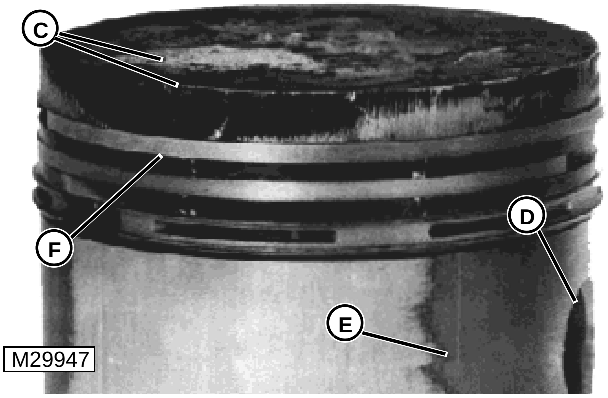
- Increased or high oil consumption.
- Increased deposits in combustion chamber.
- Sticking compression rings.

ANALYZE PISTON WEAR

DETONATION—



Detonation is uncontrolled combustion (A) caused by excessive temperature and pressure in the combustion chamber. Commonly called carbon knock, spark knock, or timing knock; detonation occurs when the extremely hot, over-compressed, fuel-air mixture ignites spontaneously—causing a second burn point during the normal ignition cycle. This second burn then collides with the spark plug induced burn (B), causing a loud explosion and extreme shockwave.

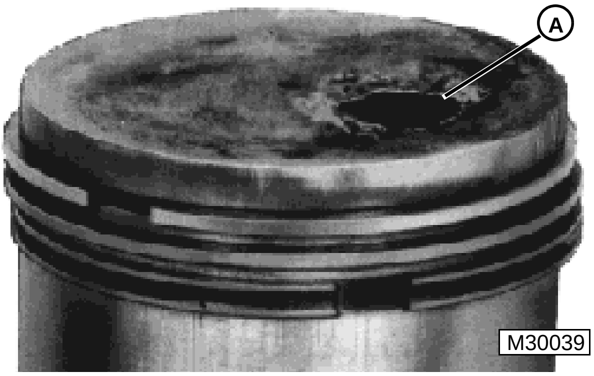


This detonation shockwave (“hammering”) of the piston inside the cylinder causes damage to piston crown (C), top ring and groove (F), piston side skirts (E), and pin locks (D).

The following is a list of possible causes for detonation:

1. Lean fuel mixture.
2. Low octane fuel.
3. Advanced ignition timing.
4. Engine lugging.
5. Buildup of carbon deposits on piston or cylinder head, causing excessive compression.
6. Wrong cylinder head or excessive milling of head increasing compression ratio.

PRE-IGNITION—

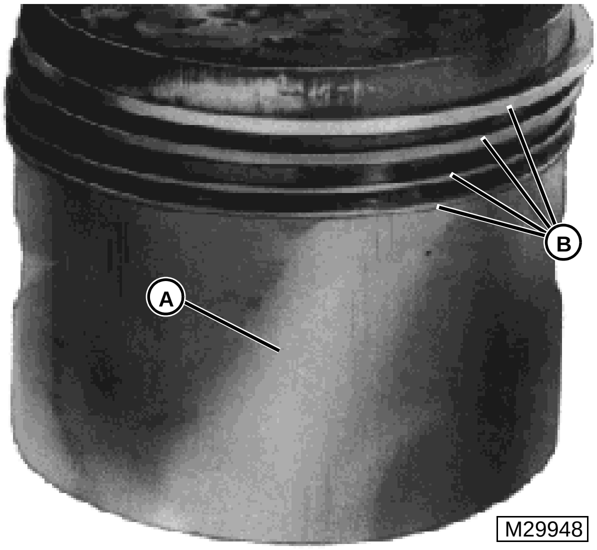


Pre-ignition is the igniting of the fuel-air mixture prior to proper ignition spark. Pre-ignition causes internal shock, resulting in pings, vibration, and power loss. Severe damage is caused to the piston crown (A), rings, and valves results from pre-ignition.

Check the following for causes of pre-ignition:

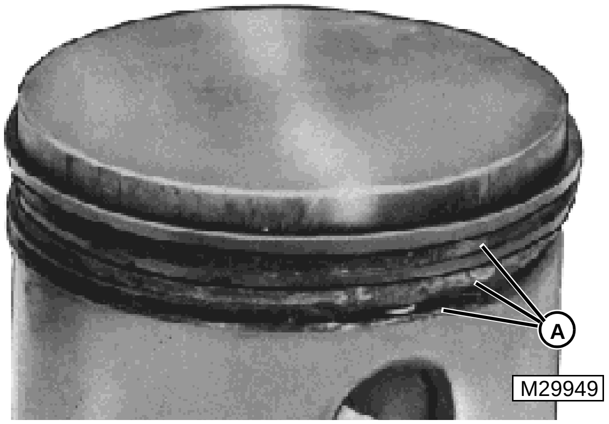
1. Hot internal carbon deposits.
2. Incorrect spark plug (high heat range).
3. Broken ceramic insulation of spark plug.
4. Hot sharp edges on valves.

IMPROPER ROD AND PISTON ALIGNMENT—



Check rod and piston alignment when piston shows a diagonal wear pattern (A) extending across the skirt of the piston. Contact with the cylinder wall shows on bottom of skirt at left and ring lands on the right (B).

CYLINDER BORED IMPROPERLY—



A cylinder bored at an angle to the crankshaft may result in improper ring contact with the cylinder which may cause the following:

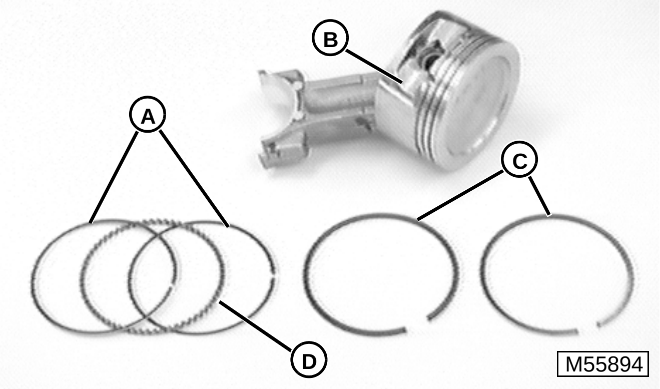
1. Rapid and uneven piston ring wear.
2. Rapid and uneven piston wear.
3. Loose or broken piston pin retaining rings.
4. Excessive oil consumption.

A broken piston pin retaining ring caused the damage (A) shown. Piston pin retaining rings loosen or break due to:

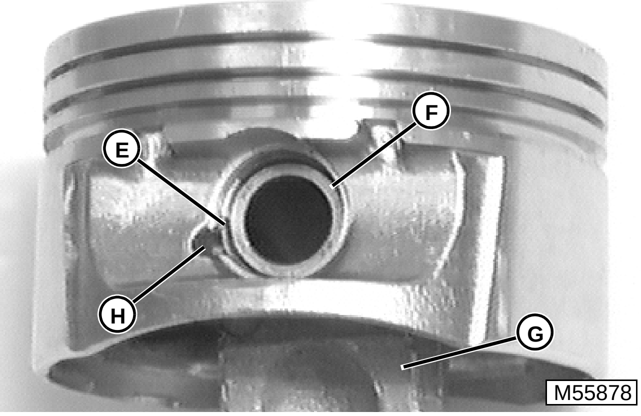
1. Rod misalignment.
2. Excessive crankshaft end play.
3. Crankshaft journal taper.
4. Weak piston pin retaining rings.
5. Incorrectly installed piston pin retaining rings.

Inertia can also cause a broken piston pin retaining ring to beat out the piston and cylinder, causing extensive damage.

PISTON ASSEMBLY—DISASSEMBLE



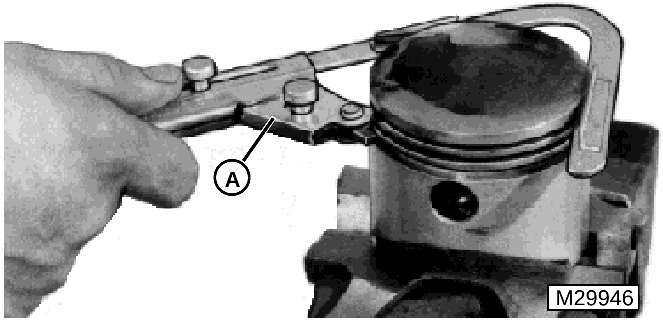
1. Remove compression rings (C) from piston (B) using ring expander.
2. Remove rails (A).
3. Remove spacer (D).



4. Remove retaining rings (E) by prying at indent (H).
5. Use wooden dowel to remove pin (F) from piston and connecting rod (G).
6. Inspect parts.

PISTON INSPECTION

1. Carefully remove piston rings.



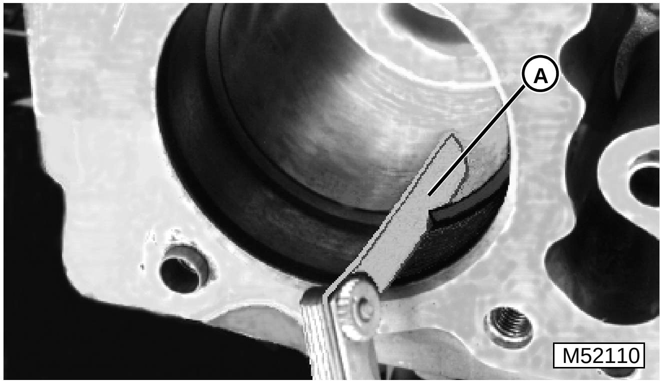
IMPORTANT: Do not use caustic cleaners or wire brush to clean aluminum piston. Piston damage can result.

2. Clean piston. Inspect for scoring or fractures.
3. Clean carbon from grooves using ring groove tool (A).

PISTON RING END GAP MEASUREMENT

IMPORTANT: If new rings are to be installed, deglaze cylinder so rings will seat properly. (See Deglaze Cylinder Bore, later in this section.)

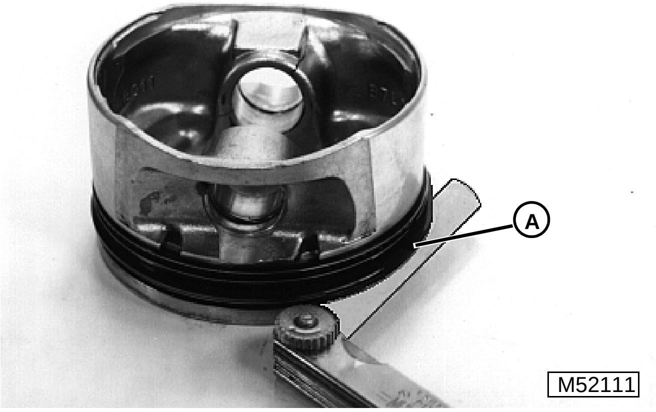
1. Use a clean or new piston to push piston compression ring squarely into bore, to a point where it normally runs.



2. Measure end gap (A).
3. Remove ring and file ends squarely until gap meets specification. Rings with too large a gap must be replaced. If one piston ring needs replaced, all must be replaced as a set.

Piston Ring End Gap (New Bore)
(12.5, 13, 14 hp) . . . . 0.3—0.5 mm (0.012—0.020 in.)
(15 hp) . . . . 0.27—0.51 mm (0.010—0.020)
Piston Ring End Gap (Used Bore) (Max)
(12.5, 13, 14 hp, 15hp) . . . . 0.77 mm (0.030 in.)

PISTON RING SIDE CLEARANCE



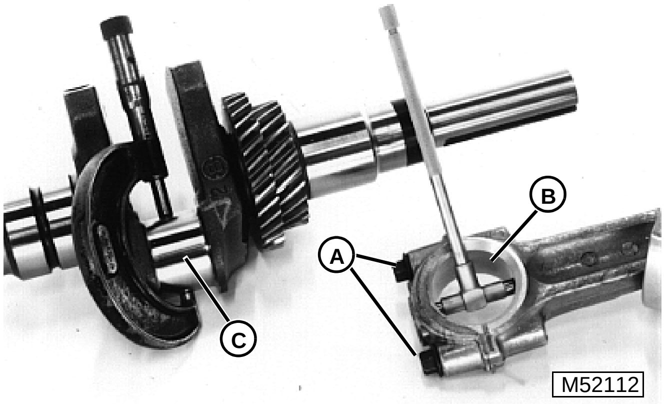
1. Measure piston ring side clearance (A) as shown at several points around piston.
2. Replace piston if measurements exceed clearance specifications.

Piston Ring-To-Groove Side Clearance
Top Compression Ring
(12.5, 13, 14 hp)
. . . . 0.040—0.105 mm (0.002—0.004 in.)
(15 hp) . . . . 0.060—0.105 mm (0.002—0.004 in.)

Middle Compression Ring
(12.5, 13, 14 hp)
. . . . 0.040—0.072 mm (0.0016—0.0028 in.)
(15 hp) . . . . . . 0.040—0.085 mm (0.0015—0.0002 in.)

Oil Control Ring
(12.5, 13, 14 hp)
. . . . 0.551—0.675 mm (0.0217—0.0266 in.)
(15 hp) . . . . . . 0.176—0.026 mm (0.0069—0.0010 in.)

PISTON ASSEMBLY MEASUREMENT



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NOTE: Connecting rod is available 0.25 mm (0.010 in.) undersize.

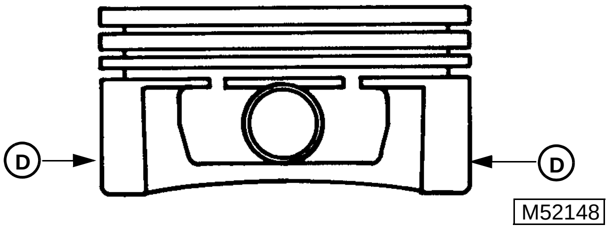
1. Tighten cap screws (A) to specification.
2. Measure inside diameter of connecting rod (B).
3. Measure outside diameter of crankshaft journal (C).
4. Determine connecting rod-to-crankshaft clearance.

Replace parts that are not within specifications.

Crankshaft Specifications:

Connecting Rod Journal OD

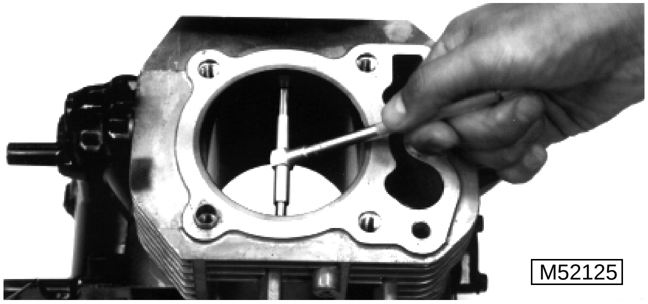
New . . . . . . 38.958—38.970 mm (1.5338—1.5343 in.)
Wear Limit. . . . . 38.94 mm (1.5328 in.)
Taper (maximum) . . . . 0.012 mm (0.0005 in.)
Out-Of-Round (max) . . . . 0.025 mm (0.0010 in.)
Crankshaft-to-Connecting Rod Clearance
New . . . . 0.030—0.055 mm (0.0012—0.0025 in.)
Wear Limit. . . . . (0.07 mm (0.0025)
Connecting Rod Specifications:
Piston Pin End ID
New . . . . 19.015—19.023 mm (0.7486—0.7489 in.)
Wear Limit. . . . . 19.036 mm (0.7495 in.)
Piston Pin OD.
New . . . . . 18.995—19.00 mm (0.7478—0.7480 in.)
Wear Limit. . . . . (18.994 mm (0.7477 in.)
Connecting Rod Cap Screws Torque
8 mm Straight Shank . . . . . . 22.6 N•m (200 lb-in.)
Step Down Shank. . . . . 14.6 N•m (130 lb-in.)
6 mm Straight Shank . . . . . . 11.3 N•m (100 lb-in.)



M52148

5. Measure diameter of piston at point (D). Point (D) is 6 mm (0.25 in.) from skirt bottom and perpendicular to piston pin.

Piston Thrust Face OD
12.5, 13, 14 hp
. . . . 86.941—86.959 mm (3.4229—3.4236 in.)
Wear Limit. . . . . 86.814 mm (3.4179)
15 hp . . . . . 89.951—89.969 mm (3.5413—3.5420 in.)
Wear Limit. . . . . 89.824 mm (3.5363)



M52125

6. Measure cylinder bore.
7. Replace piston and/or rebore cylinder block if not within specifications.

Piston Specifications:

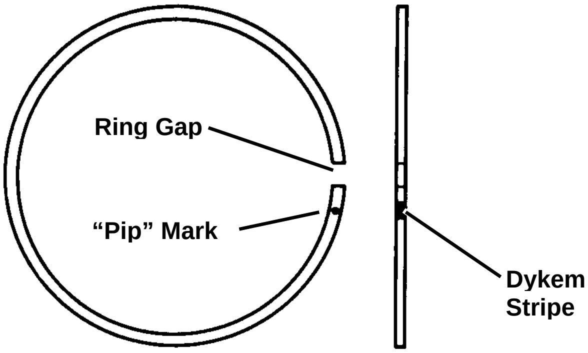
Thrust Face to Cylinder Bore Clearance (New)
12.5, 13, 14 hp
. . . . 0.041—0.044 mm (0.0016—0.0017 in.)
15 hp . . . . 0.031—0.043 mm (0.0012—0.0016 in.)

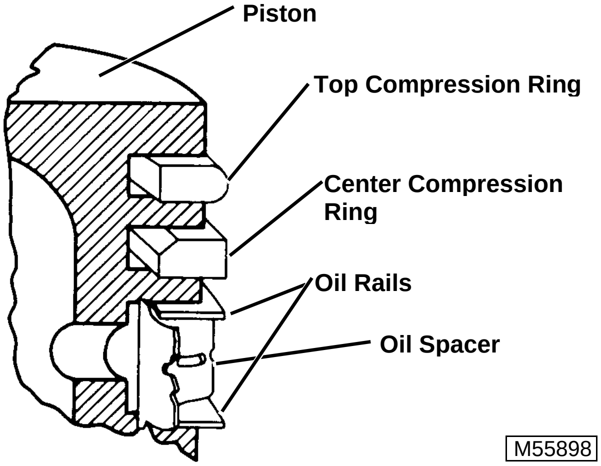
Piston Pin Bore ID.

New . . . . . . 19.006—19.012 mm (0.7483—0.7485 in.)
Wear Limit. . . . . 19.025 mm (0.7490 in.)

PISTON ASSEMBLY

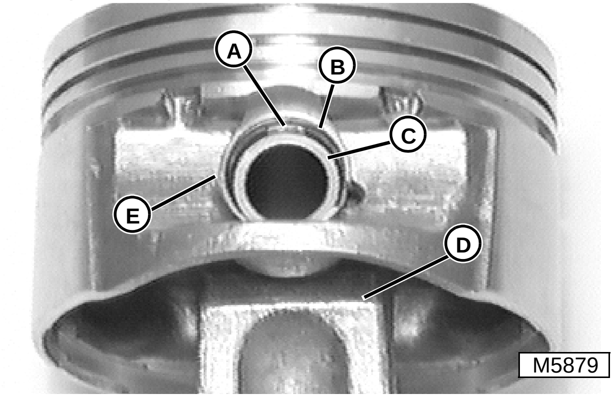
IMPORTANT: Side of ring marked TOP faces top of piston with Dykem stripe to left of end gap. Top compression ring has a blue Dykem stripe. Bottom compression ring has a pink Dykem stripe.





1. Install rings as shown on piston using ring expander.
   - Compression ring gaps should be staggered 120°.
   - Note shape of compression rings and install as shown.
   - Compression rings should be installed with "Pip" mark up and Dykem strip to left of ring gap.
   - Install oil ring spacer first. Make sure that its ends do not overlap.
   - Stagger end gasp of oil rails 180° apart.
   - Rings should turn freely in grooves.

NOTE: Install piston pin before retaining ring to prevent possible scoring of bore.

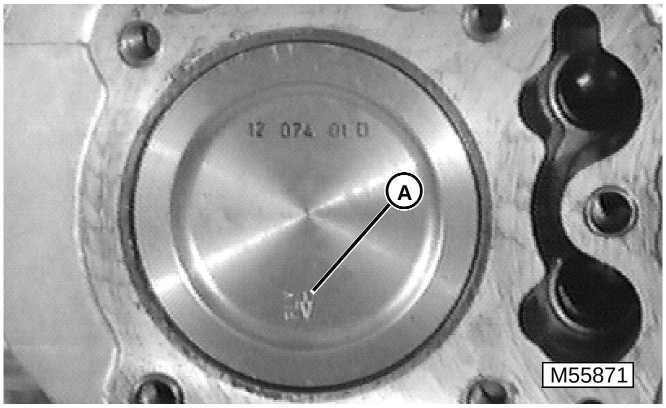


IMPORTANT: Retaining rings (B) should be installed with end gap (A) pointing up.

2. Install one piston pin retaining ring (B) in groove of piston bore (E).
3. Install pin (C) through piston bore (E) and connecting rod (D). Pin should install easily with thumb pressure.
4. Install remaining retaining ring (B) in opposite side.

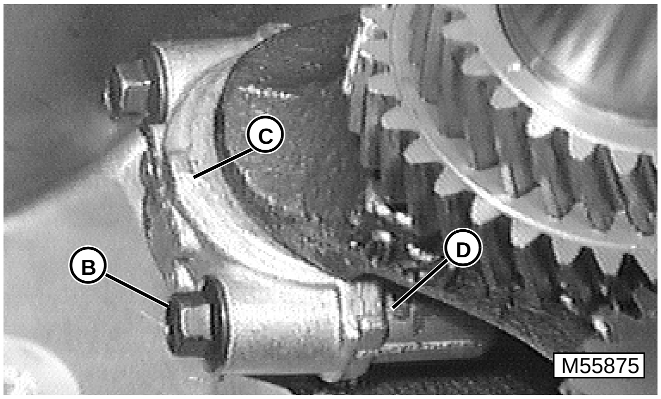
INSTALL PISTON ASSEMBLY

1. Install piston rings so piston ring end gaps are staggered 120° apart.
2. Compress rings with ring compressor tool.
3. Coat cylinder, piston skirt, rod, and cap bearing surfaces with oil.



4. Install piston with FLY mark (A) toward flywheel side of crankcase. Use wooden dowel to push piston into bore.

INSTALL CONNECTING ROD



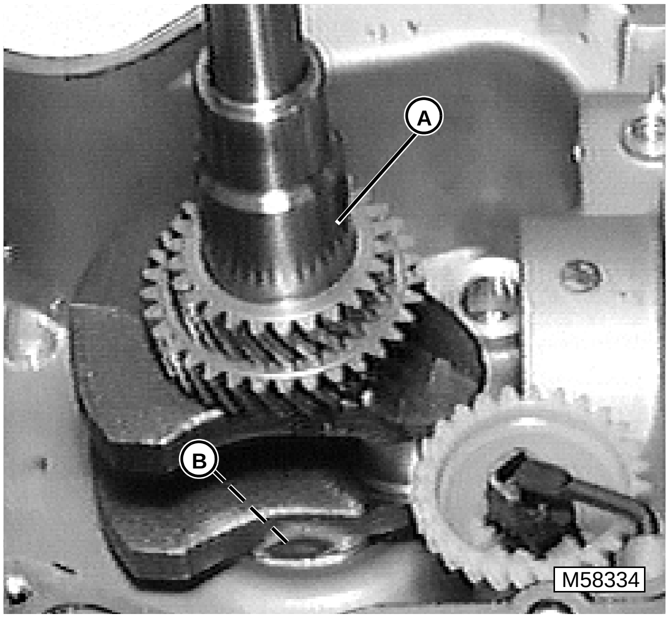
5. Fasten connecting rod (D) and cap (C) to crankshaft.
6. Tighten cap screws (B) to specification.
7. Check connecting rod to crankshaft side clearance. Replace if not within specification.
8. Install balance shaft, camshaft, oil pan, and cylinder head. See appropriate procedures in this section.

Connecting Rod Specifications:

Cap Screw Torque
8 mm Straight Shank . . . . 22.6 N•m (200 lb-in.)
Step Down Shank. . . . . 14.6 N•m (130 lb-in.)
6 mm Straight Shank . . . . 11.3 N•m (100 lb-in.)
Side Clearance . . . 0.18—0.41 mm (0.007—0.016 in.)

CRANKSHAFT REMOVAL & INSTALLATION

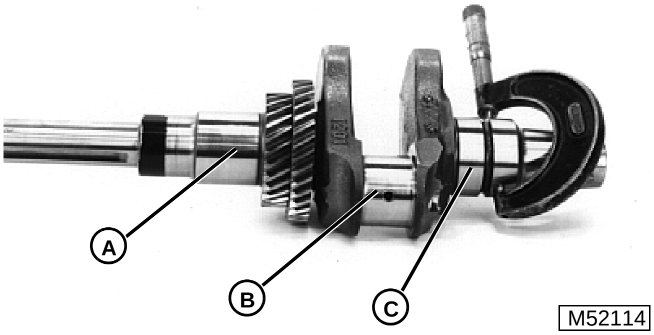
1. Remove camshaft and balancer assemblies.



2. Remove and inspect crankshaft (A).
3. Install new seals (B) in crankcase and oil pan.
4. Install crankshaft carefully, DO NOT damage seals.

CRANKSHAFT & MAIN BEARING INSPECTION

1. Inspect for cracks or chipped teeth.

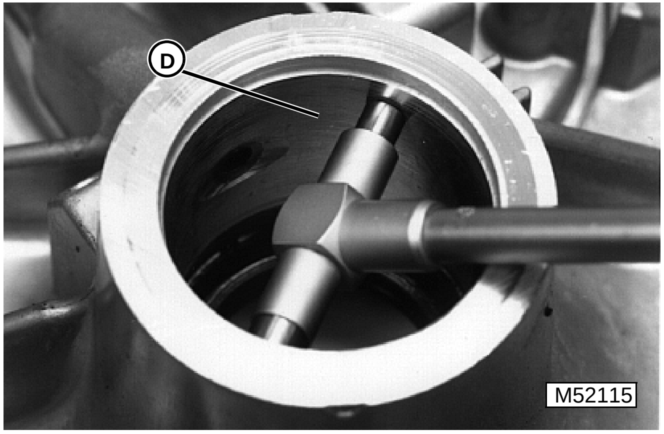


2. Check crankshaft alignment, see next heading.
3. Measure journals (A), (B), and (C).

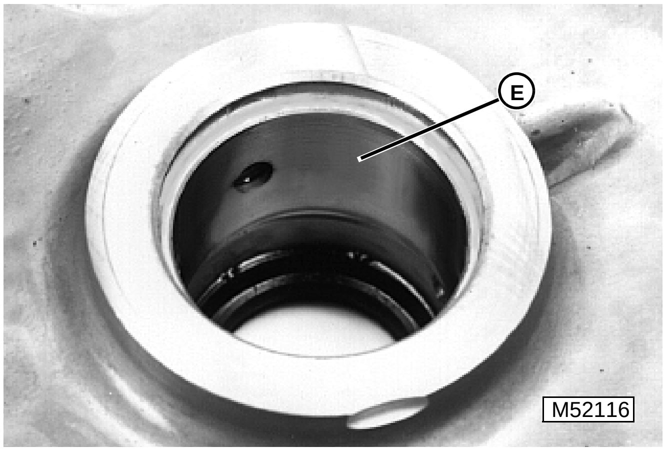
Replace crankshaft if bent, damaged, or not within specifications.

Crankshaft Bearing Journal Specifications:

Oil Pan End Main Journal OD:
New . . . . . . 41.915—41.935 mm (1.6502—1.6510 in.)
Wear Limit. . . . . 41.86 mm (1.648 in.)
Taper (maximum) . . . . 0.020 mm (0.0008 in.)
Out-of-Round (maximum) . 0.025 mm (0.0010 in.)
Flywheel End Main Journal OD:
New . . . . 41.913—41.935 mm (1.7682—1.7691 in.)
Wear Limit. . . . . 44.84 mm (1.765 in.)
Taper (maximum) . . . . 0.022 mm (0.0009 in.)
Out-of-Round (maximum) . 0.025 mm (0.0010 in.)
Connecting Rod Journal OD:
New . . . . . . 38.958—38.970 mm (1.5338—1.5343 in.)
Wear Limit. . . . . 38.94 mm (1.5328 in.)
Taper (maximum) . . . . 0.012 mm (0.0005 in.)
Out-of-Round (maximum) . 0.025 mm (0.0010 in.)



4. Measure inside diameter of crankshaft main bearing bore (D) in oil pan.



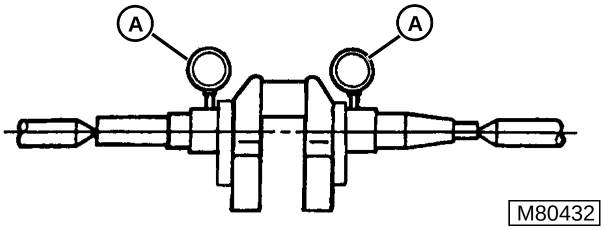
5. Measure inside diameter of crankshaft main bearing bore (E) in crankcase.
6. Subtract journal OD. from bore ID. to determine if clearance is within specifications. Replace parts if not within specifications.

Crankshaft Sleeve Bearing Bore Specifications:

Oil Pan & Crankcase Main Bearing Bore ID
47.98—48.03 mm (1.889—1.891 in.)

Main Bearing Bore-to-Crankshaft Clearance. 0.03—0.09 mm (0.001—0.004 in.)

CRANKSHAFT ALIGNMENT



In alignment jig:

- Rotate crankshaft slowly. Dial indicators (A) measure maximum Total Indicated Runout (TIR).

In engine:

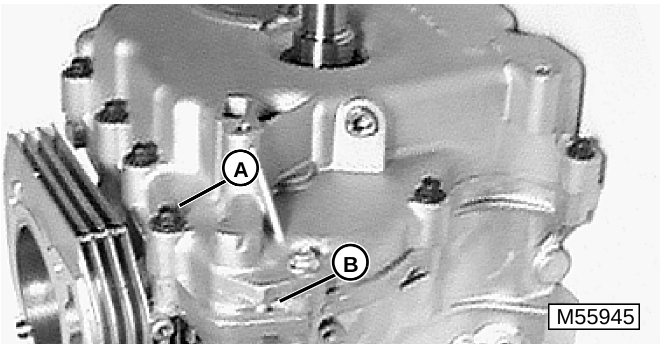
- Rotate crankshaft slowly. Measure TIR at oil pan end of crankshaft using dial indicator.

Replace crankshaft if not within specification.

Specifications:

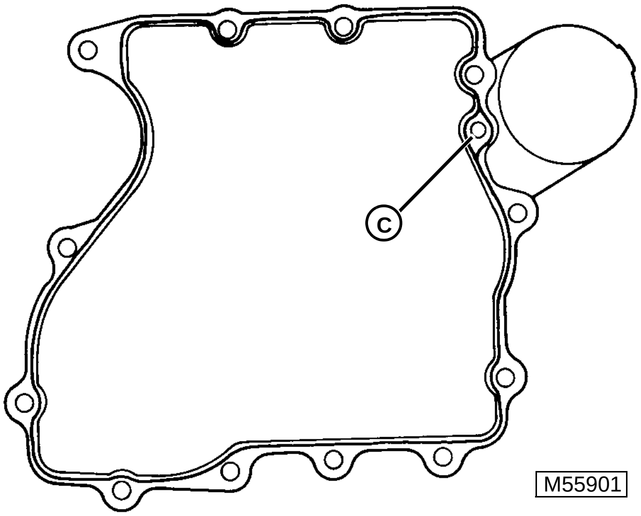
Crankshaft Maximum TIR
In Alignment Jig . . . . 0.10 mm (0.004 in.)
In Engine . . . . 0.15 mm (0.006 in.)

REMOVE AND INSTALL OIL PAN



NOTE: Do not pry on gasket surface when removing oil pan from crankcase.

1. Remove cap screws (A).
2. Pry oil pan from crankcase using flat blade screwdriver on splitting tabs (B).
3. Clean mating surfaces of crankcase and oil pan.
4. Replace crankshaft seals, see Remove And Install Oil Pan Seal and Remove And Install Crankcase Seal.



IMPORTANT: DO NOT get sealant in oil passage (C). Apply just enough to seal both sides of oil passage when case halves are fastened together.

5. Apply 1.6 mm (1/16 in.) bead of RTV silicone sealant to oil pan flange. DO NOT block oil passage (C).
6. Apply grease to inside lip of crankshaft main bearing seal.
7. Install oil pan over crankshaft carefully to avoid damaging main bearing seal.

IMPORTANT: Be sure to align flats of balancer shaft and oil pump inner rotor when installing oil pan.

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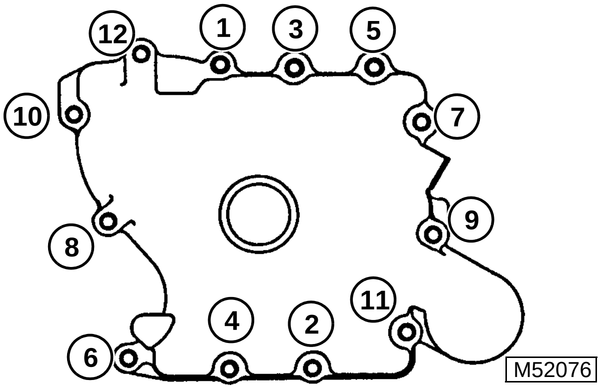
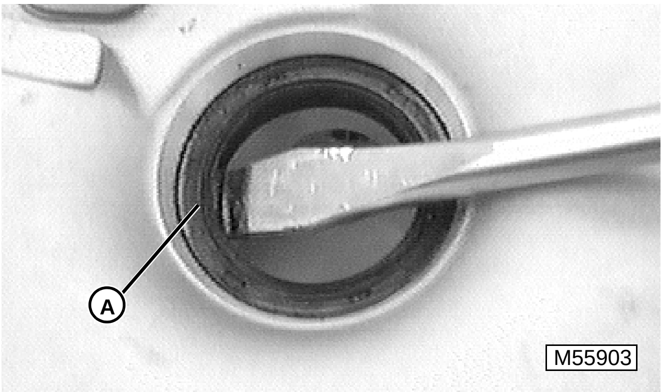


8. Install oil pan onto crankcase.
9. In sequence shown, tighten oil pan cap screws to specification.

Specification:

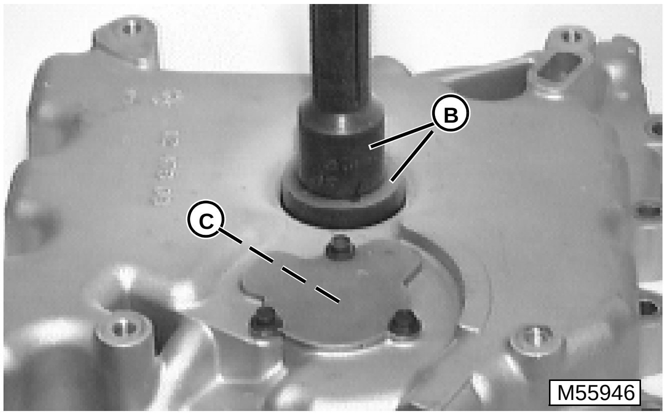
Oil Pan Cap Screws . . . . 24 N•m (216 lb-in.) .

REMOVE AND INSTALL OIL PAN SEAL



IMPORTANT: DO NOT damage pan bore when removing seal.

1. Remove and discard seal (A).
2. When replacing crankshaft seals, apply a thin film of LOCTITE®[1] 598 or equivalent to the OD. of seal



3. Using a suitable driver and disc (B), install new oil seal to specification.

Specification:

Oil Pan Seal Depth

. . . . 2.49—2.98 mm (0.098—0.117 in.)

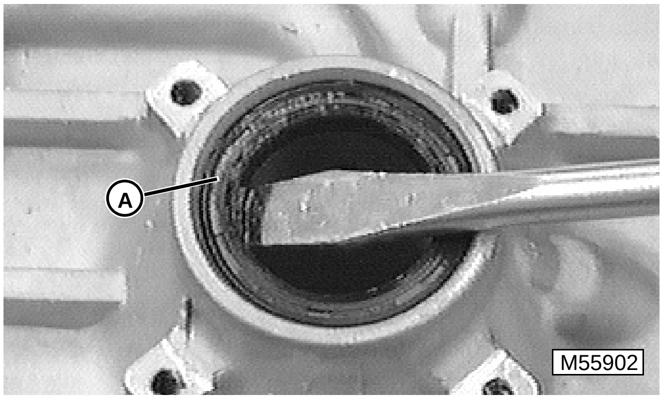
or until its top surface is flush with machined bore opening.

4. Apply grease to inside lip of seal to aid installation.

IMPORTANT: Be sure to align flats (C) of balancer shaft and oil pump inner rotor when installing oil pan.

5. Prepare and install oil pan, see Remove And Install Oil Pan.

REMOVE AND INSTALL CRANKCASE OIL SEAL



IMPORTANT: DO NOT damage crankcase bore when removing seal.

1. Remove and discard crankcase oil seal (A).
2. When replacing crankshaft seals, apply a thin film of LOCTITE® 598 or equivalent to the OD. of seal.
3. Using a suitable driver and disc, install new oil seal to specification.

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[1] Loctite is a product of the Loctite Corporation.

Specification:

Crankcase Seal Depth

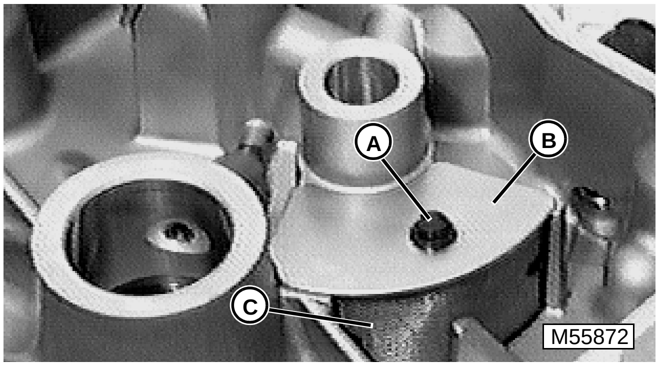
. . . . . 4.0 mm (0.157 in.)

or until its top surface is flush with machined bore opening.

IMPORTANT: Coat inside seal lip with grease to aid installation. Install crankshaft carefully to avoid damaging seal.

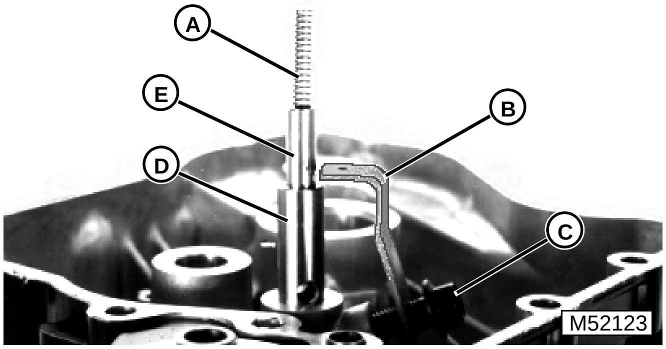
4. Carefully install crankshaft seal.

INSPECT OIL PICKUP



1. Remove cap screw (A) and plate (B) to remove pickup screen (C).
2. Clean screen with approved solvent. Replace if damaged.
3. Install screen, plate, and cap screw.
4. Install oil pan, see Remove and Install Oil Pan.

OIL PUMP RELIEF VALVE INSPECT ION



1. Loosen cap screw(C) and retainer (B) to gain access to individual components.
2. Remove and measure spring (A), replace if not to specification.

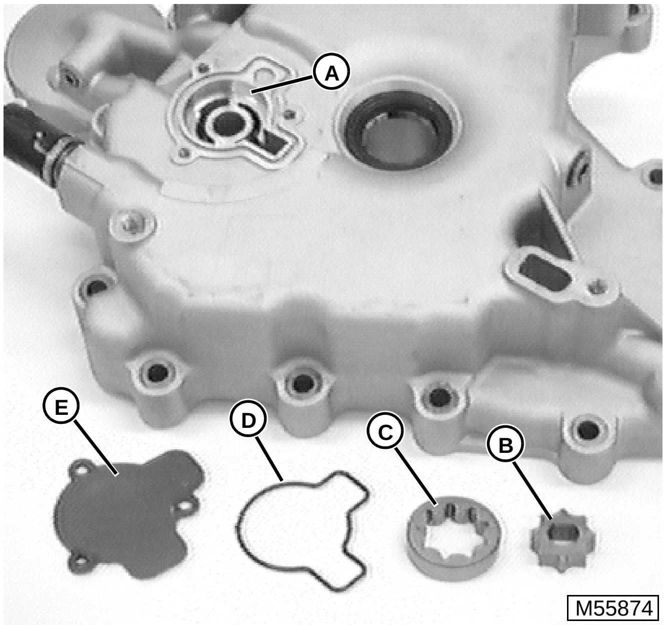
Specification:

Relief Valve Spring Free Length

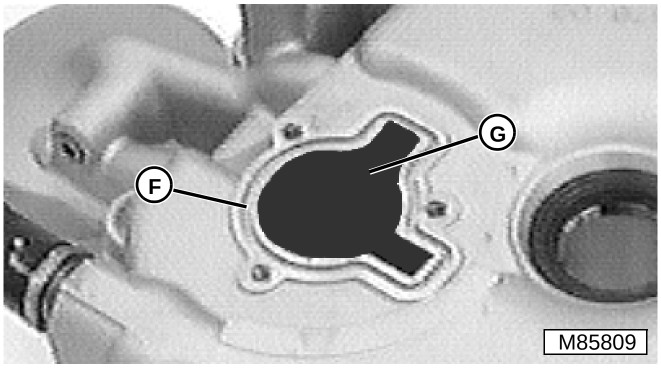
. . . . . 25.1968 mm (0.992 in.)

3. Inspect spring, piston (E), and body (D). Replace parts that are damaged or worn.
4. Install components with retainer and cap screw.
5. Install oil pan, see Remove And Install Oil Pan.

OIL PUMP INSTALLATION



1. Remove cover (E), O-ring (D), pump outer rotor (C), and pump inner rotor (B).
2. Inspect rotor, pump, and inside surface of cavity (A) for scoring, discoloration, and wear.



IMPORTANT: If oil leaks out between engine oil base and tractor frame and not from the crankshaft seal, check O-ring groove (F) for casting flaws. If flashing is found in O-ring groove, cover the oil pump rotors to prevent contamination (G), use the sharpened end of a screwdriver as a chisel or a small file to remove flashing. Be careful not to gouge the bottom of the O-ring groove. Remove all chips or filings from the groove. (Recommend using a Q-Tip®).

3. Replace parts as necessary.
4. Lubricate parts (A, B, and C) with engine oil. Install in cavity.
5. Install O-ring and cover. Tighten cap screws to specification.

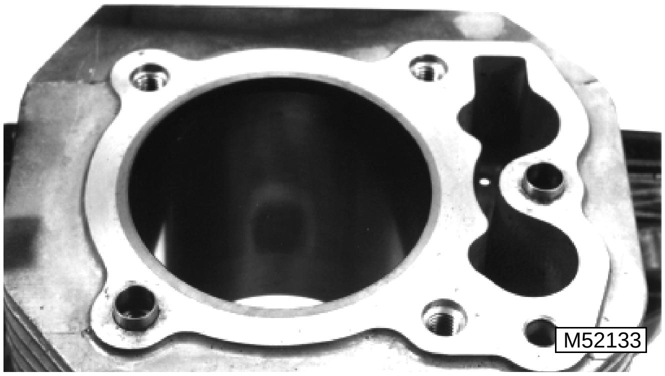
Oil Pump Cover Cap Screw Specification:

New Oil Pan (Thread Forming) . . 6.2 N•m (55 lb-in.)

Used Oil Pan (Threads Cut). . . . . 4.0 N•m (35 lb-in.)

Oil Pump Cover-to-Rotor Clearance . . . . 0.076 mm (0.003 in.)

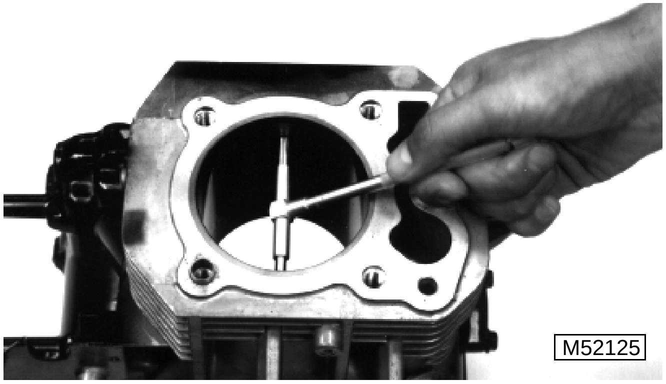
CYLINDER BLOCK REMOVE & INSTALL



All components must be removed from block before inspection or machine work can be performed.

CYLINDER BLOCK INSPECT

1. Clean and check block for cracks.
2. Cracks not visible to the eye may be detected by coating the suspected area with mixture of 25 percent kerosene and 75 percent light engine oil.
3. Wipe area dry and immediately apply coating of zinc oxide dissolved in wood alcohol. If crack is present, coating becomes discolored at the defective area.
4. Replace block if any cracks are found.



5. Measure cylinder bore inside diameter at six places; two measurements 90° apart at top, middle, and bottom of ring travel.
6. Measure piston outside diameter perpendicular to piston pin bore.

NOTE: Pistons and rings are available 0.25 and 0.50 mm (0.010 and 0.020 in.) oversize.

Replace block or bore cylinder to accept larger piston if clearance exceeds specification.

Cylinder Bore Specifications:

12.5, 13, 14 hp
New . . . . 87.000—87.025 mm (3.4252—3.4262 in.)
Wear Limit. . . . . 87.063 mm (3.4277 in.)

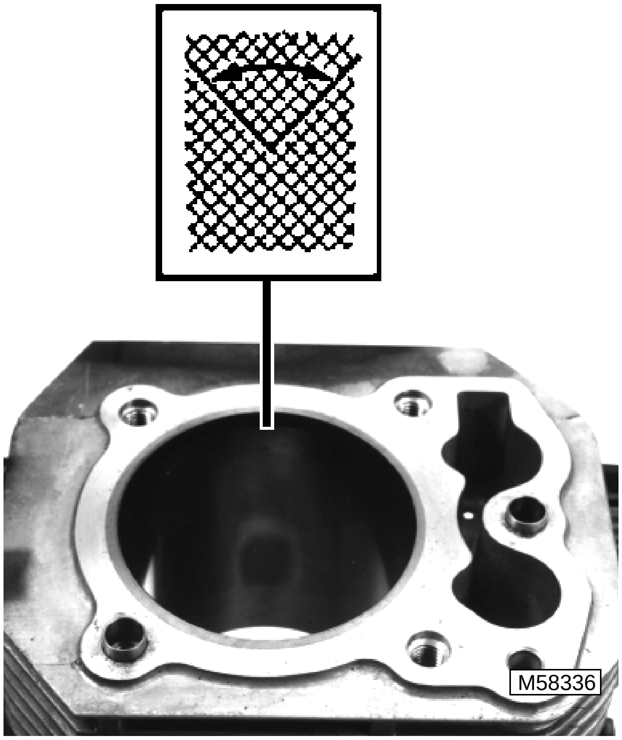
15 hp
New . . . . 90.000—90.025 mm (3.5433—3.5443 in.)
Wear Limit. . . . . 90.63 mm (3.5681 in.)
Out-of-Round (maximum) . . 0.12 mm (0.0047 in.)
Taper (maximum) . . . . 0.05 mm (0.0020 in.)

Piston-to-Cylinder Clearance
12.5, 13, 14 hp. . . . . 0.041—0.044 mm(0.0016—0.0017 in.)
15 hp . . . . . 0.031—0.043 mm(0.0012—0.0016 in.)

CYLINDER BORE DEGLAZING

IMPORTANT: Remove crankshaft and internal engine components when deglazing cylinder. Abrasives can cause engine damage.

1. Use the appropriate size flex-hone to deglaze cylinder bore.



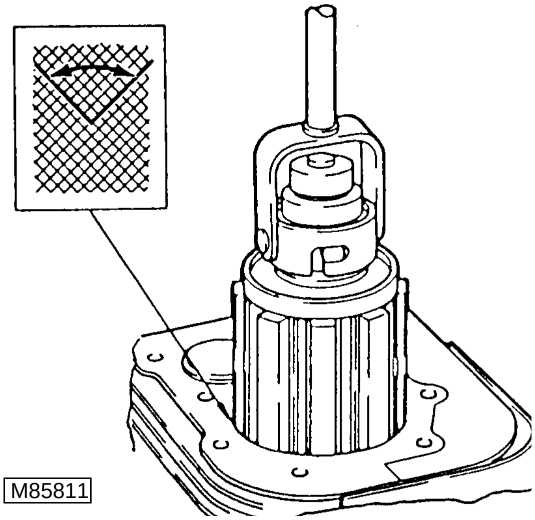
2. Deglaze cylinder bore using flex-hone to obtain **23—33°** crosshatch pattern.
3. Clean abrasive residue from cylinder using warm soapy water until clean white rags show no discoloration.
4. Dry cylinder and apply engine oil.

Specification:

Deglaze Crosshatch Pattern . . . . 23—33°

REBORE CYLINDER BLOCK

IMPORTANT: Check stone for wear or damage. Use correct stone.


M85811

NOTE: The cylinder block can only be rebored to use 0.25 and 0.50 mm (0.010 and 0.020 in.) oversize pistons and rings.

1. Align center of bore to drill press center.
2. Adjust hone so lower end is even with lower end of cylinder bore.
3. Adjust coarse hone stones until they contact narrowest point of cylinder.
4. Coat cylinder with honing oil. Hone should turn by hand. Adjust if too tight.
5. Run drill press at about **250 rpm**. Move hone up and down about **60 times per minute**.
6. Stop press and check cylinder diameter several times during honing.

*NOTE: Finish should not be smooth. It should have a **23—33°** crosshatch pattern.*

7. Remove hone when cylinder is within **0.06 mm (0.0025 in.)** of desired size.
8. Hone with burnishing stones until within **0.013 mm (0.0005 in.)** of desired size.
9. Hone with finish stones (220—280 grit) to final size.
10. Allow cylinder to cool completely; then, measure for new piston-to-cylinder bore running clearance, taper, and out-of-round.

IMPORTANT: Do not use solvents to clean cylinder bore. Solvents will not remove metal particles produced during honing.

11. Clean cylinder thoroughly using warm soapy water until clean white cloths show no discoloration.
12. Dry cylinder completely and apply thin coat of engine oil to appropriate mating surfaces.

Specifications:

Oversize Limits

Initial	**0.25 mm (0.010 in.)**
Final	**0.50 mm (0.020 in.)**
Drill Speed	**250 rpm**
Hone Cycles	**60 per minute**
Bore Crosshatch Pattern	**23—33°**

Initial Bore Size—Coarse Stone
. . . . Until within 0.06 mm (0.0025 in.) of desired bore size

Secondary Bore Size—Burnish Stone
. . . . Until within 0.13 mm (0.0005 in.) of desired bore size

Final Bore Size—Finish Stone
. . . . Using 220—280 grit finishing stones bore to desired size

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Battery:

Voltage	12
BCI group	U-1
CCA rating (Amps at -18°C (0°F),	160
Reserve capacity (minutes at 25 Amps)	20
Specific gravity (minimum)	1.225 points
Electrolyte required fill (Approximate)	1.9 L (2.0 qt)
Load test (minimum)	255 amp for 15 seconds

Ignition:

Primary coil resistance	
One direction	5 - 1000 ohms
Other direction (Minimum)	30 K ohms
Secondary (Plug wire and core)	7.9 - 10.85 K ohms
Air gap	0.2 - 0.3 mm (0.008 - 0.012 in.)

Spark Plug:

Gap	1.00 mm (0.040 in.)
Torque	38-43 N•m (28-32 lb-ft.)

Starter:

Type	Bendix
Amp draw	
Loaded (engaging engine)	180 amps at 225 engine rpm

Stator:

Stator size	15 amp
Regulated voltage at high idle (minimum)	12.2 - 14.7 volts
Unregulated voltage at high idle:	
Export	24 VAC
Domestic	28 VAC

PTO Clutch:

Coil Resistance	3-10 Ohms
Current Draw	3.5 Amps

OTHER MATERIAL

Number	Name	Use
PT569	John Deere NEVER-SEEZ® Lubricant	Lubricate crankshaft.

THEORY AND DIAGNOSTIC INFORMATION

THEORY OF OPERATION INFORMATION

The theory of operation stories divide the electrical system into individual circuits by function. Each circuit is isolated from the main wiring schematic and only shows the components that are used in it. The story contains information on function, operating conditions, and theory of operation. The circuit schematics are drawn with the components in the operating position, with the power, or battery positive, into them across the top and the ground, or battery negative, across the bottom.

DIAGNOSTIC INFORMATION

The diagnostic procedures is used to test the complete circuit regardless of the problem or complaint. Select a symptom or system from the quick check or troubleshooting chart and follow the test procedures under that heading.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The middle **“NORMAL”** column gives the reading or condition that should be obtained when performing the test or check. If the results of the test or check are not normal, perform the test, check, or adjustment listed in the third **“IF NOT NORMAL”** column to repair the malfunction. The detailed tests or adjustments referred to in the **“IF NOT NORMAL”** column are located at the end of that group. The system diagram that accompanies each test procedure is drawn to resemble machine components. The key number on the art matches the number in the **“TEST LOCATION”** column and the leader line points to the exact point the test is to be made.

WIRE COLOR ABBREVIATION CHART

Blk	Black
Blu	Blue
Brn	Brown
Grn	Green
Gry	Gray
Org	Orange
Pnk	Pink
Pur	Purple
Red	Red
Tan	Tan
Wht	White
Yel	Yellow
Blk/Wht	Black/White
Blu/Wht	Blue/White
Brn/Wht	Brown/White
Brn/Yel	Brown/Yellow
Dk Blu	Dark Blue
Dk Brn/Lt Grn	Dark Brown/Light Green
Dk Brn/Red	Dark Brown/Red
Dk Brn/Yel	Dark Brown/Yellow
Dk Grn	Dark Green
Lt Blue	Light Blue
Lt Grn	Light Green
Lt Org	Light Orange
Org/Wht	Orange/White
Pnk/Blk	Pink/Black
Pur/Wht	Purple/White
Red/Blk	Red/Black
Red/Wht	Red/White
Wht/Blk	White/Black
Wht/Red	White/Red
Yel/Blk	Yellow/Black
Yel/Red	Yellow/Red
Yel/Wht	Yellow/White

READING ELECTRICAL SCHEMATICS

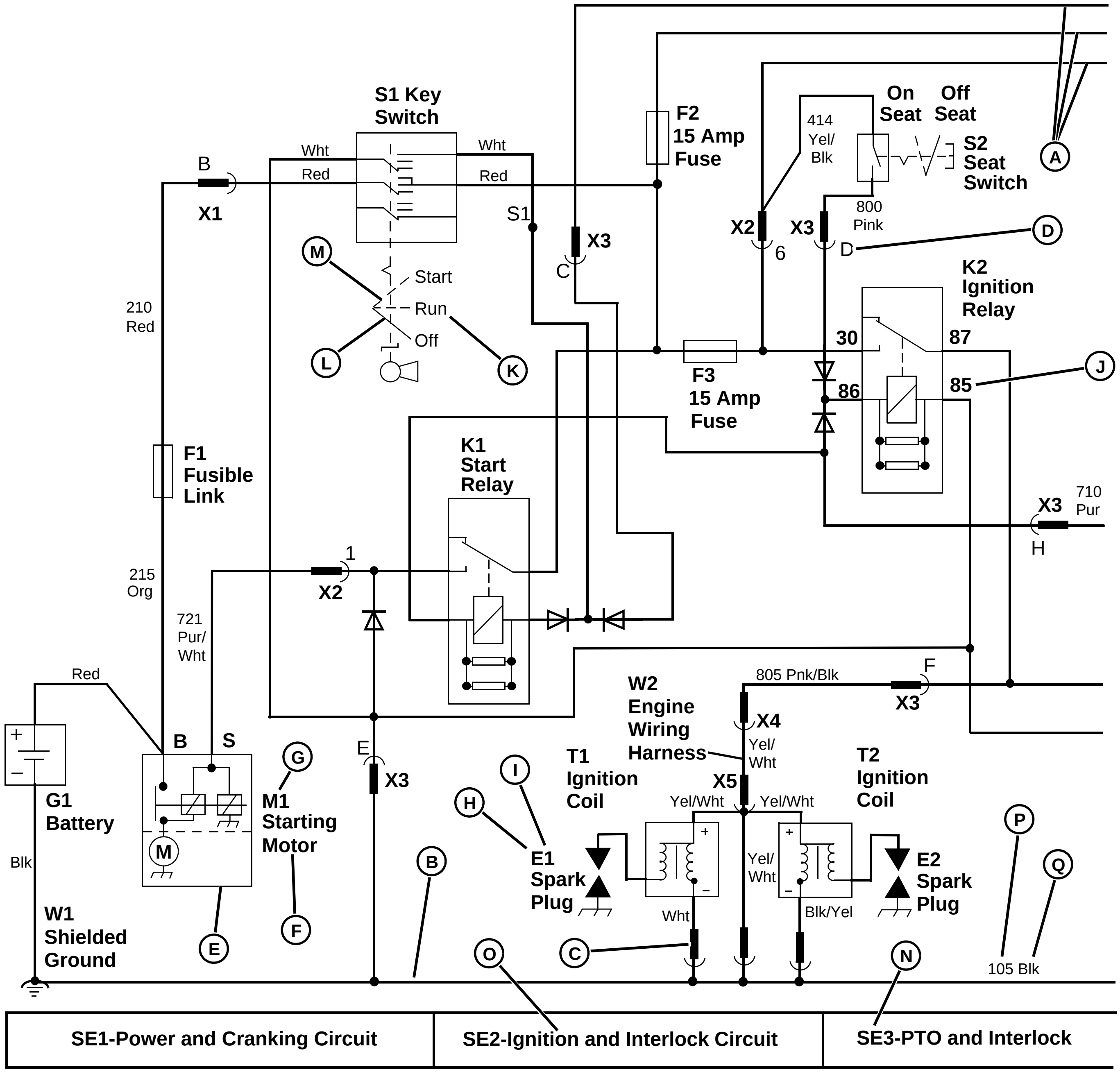
The schematic is made up of individual circuits laid out in a sequence of related functions. It is formatted with all power wires (A) across the top and all ground wires (B) across the bottom. Current flow is generally from top to bottom through each circuit and component. All components are shown in the OFF position. The diagram does not list connector (C) information unless needed to avoid confusion. If the connector is shown, the number next to it is the terminal pin location (D) in the connector.

Each component is shown by a symbol (E), its name (F), and an identification code (G). The identification code contains a device identifying letter (H) and number (I). The identifying letter is always the same for a specific component, but the identifying numbers are numbered consecutively from upper left to lower right. The terminal designation (J) is placed directly outside the symbol next to the connecting wire path. Switch positions (K) are also placed directly outside the symbol. The solid line (L) shows the position the switch is currently in and dash lines (M) represent other switch positions.

Each circuit is identified at the bottom of the drawing by a section number (N) and section name (O).

The circuit number (P) and wire color (Q) of the wires are shown directly next to the wire path.

The same component name and identification code are used consistently on all diagrams in this section. Components can be easily cross-referenced.

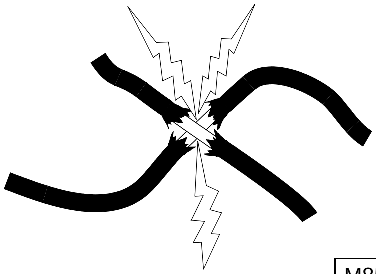


COMMON CIRCUIT TESTS

Shorted Circuit:

A shorted circuit may result in the wrong component operating (i.e. improper wire-to-wire contact). To test for a shorted or improperly wired circuit:

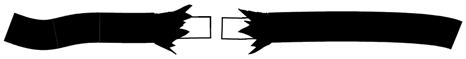
1. Turn component switch ON.
2. Start at the controlling switch of the component that should not be operating.
3. Follow the circuit and disconnect wires at connectors until component stops operating.
4. Shorted or improper connections will be the last two wires disconnected.


M85600 mif

High Resistance or Open Circuit:

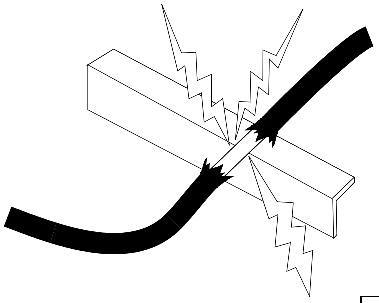
High resistance or open circuits usually result in slow, dim or no component operation (i.e. poor, corroded, or disconnected connections). Voltage at the component will be low when the component is in operation. To test for high resistance and open circuits:

1. Check all terminals and grounds of the circuit for corrosion.
2. If terminals are not corroded or loose, the problem is in the component or wiring.


M85601 mif

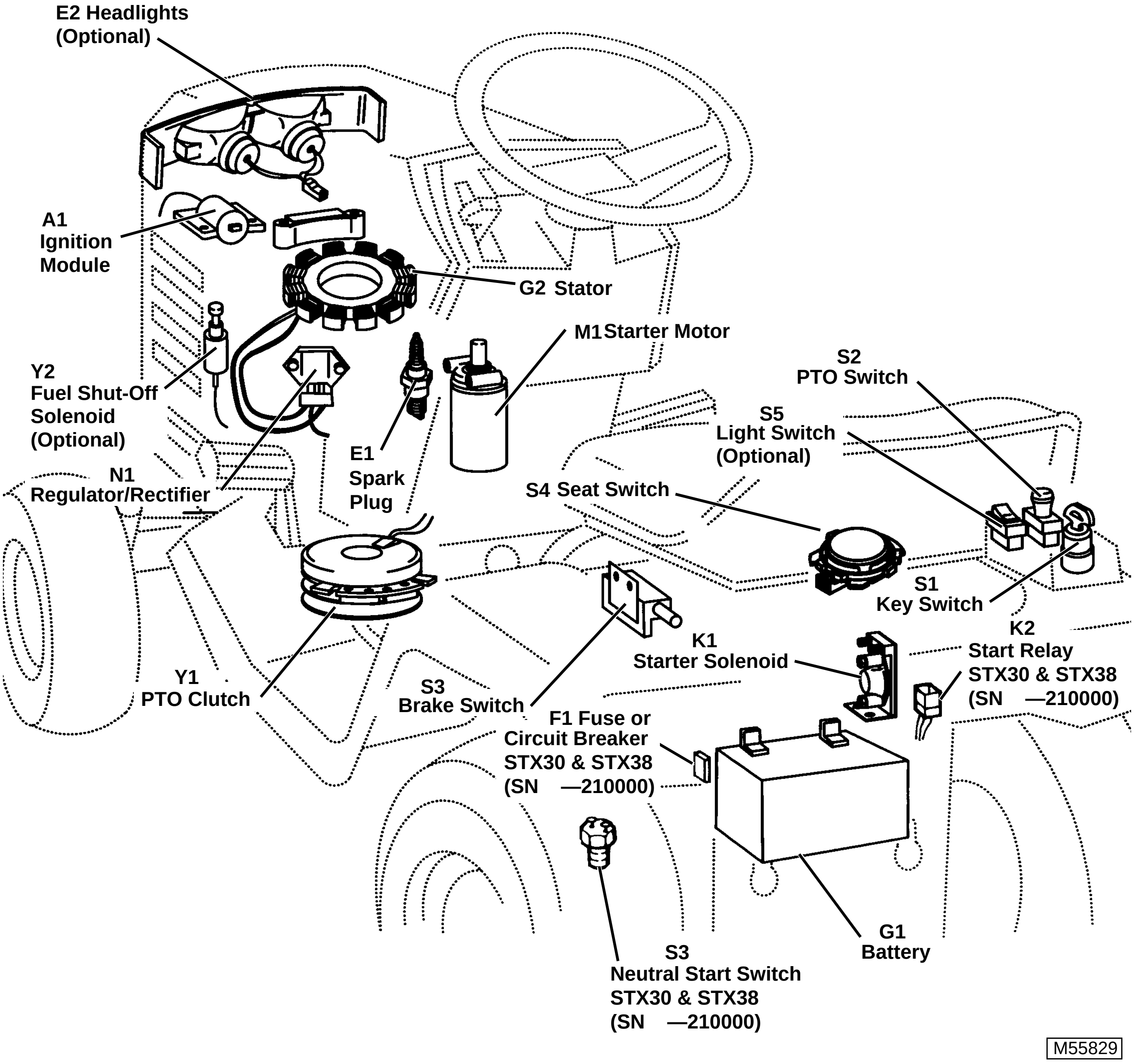
Grounded Circuit:

Grounded circuits usually result in no component operation or a blown fuse.


M85602 mif

NOTES

COMPONENT LOCATION

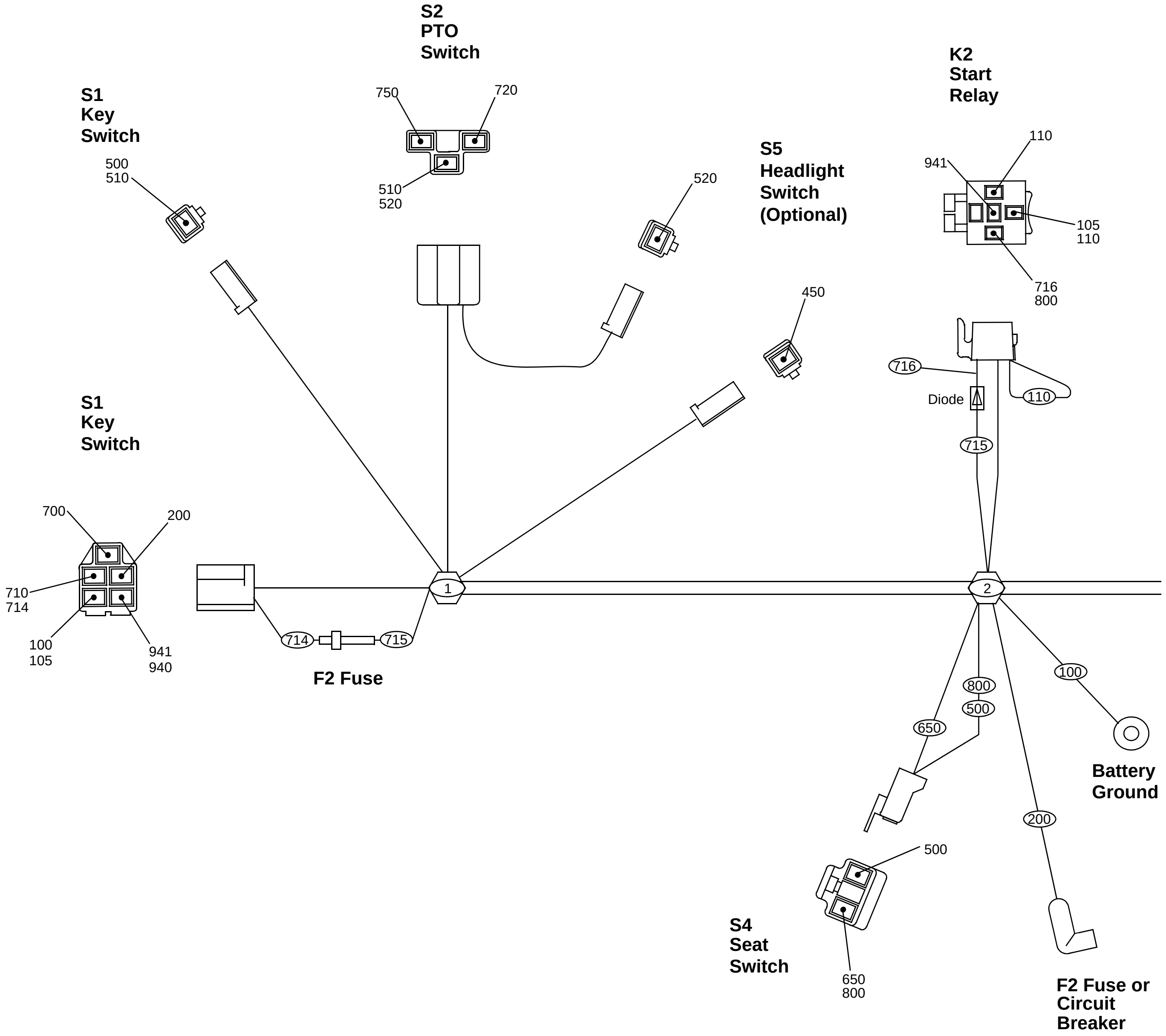

E2 Headlights (Optional)
A1 Ignition Module
G2 Stator
M1 Starter Motor
Y2 Fuel Shut-Off Solenoid (Optional)
S2 PTO Switch
S5 Light Switch (Optional)
E1 Spark Plug
N1 Regulator/Rectifier
S4 Seat Switch
S1 Key Switch
K1 Starter Solenoid
K2 Start Relay STX30 & STX38 (SN —210000)
Y1 PTO Clutch
S3 Brake Switch
F1 Fuse or Circuit Breaker STX30 & STX38 (SN —210000)
S3 Neutral Start Switch STX30 & STX38 (SN —210000)
G1 Battery
M55829

TROUBLESHOOTING

Problem or Symptom / Check or Solution	Engine will not crank.	Engine cranks but will not start.	Engine starts hard or will not stay running.	Engine misses or runs	Weak or no spark.	Engine will not shut off.	PTO clutch will not engage or will not	Battery goes dead, discharges or	Optional headlights will not turn on or will not	Optional fuel shut-off solenoid will not open.	Optional fuel shut-off solenoid will not close.	Engine dies when shift lever is engaged.	Engine dies when PTO switch is engaged.
See power circuit test points.	●			●			●	●	●	●	●	●	●
See cranking circuit test points.	●												
Check ground circuit test points.	●	●		●	●		●		●	●		●	●
Test battery and connections.	●						●	●	●	●			●
See ignition circuit test points.	●	●	●	●	●	●	●		●	●	●	●	●
See charging circuit test points.	●	●	●				●	●		●			
See starter tests.	●												
See PTO circuit test points.		●	●				●						●
See optional headlight circuit test points.									●				
See optional fuel shut-off solenoid circuit test points.		●	●							●	●		
Check for shorted circuit.	●	●	●		●	●	●	●	●	●	●	●	●
Check for high resistance or open circuit.	●	●	●		●	●	●	●	●	●	●	●	●
Check for correct spark plug and spark plug air gap.		●	●	●	●								
Check for correct ignition module to flywheel magnet air gap.		●	●	●	●								
Check strength of flywheel ignition module magnet and/or flywheel stator magnets.		●	●	●	●		●	●					
See fuel and air system tests and adjustments.		●	●	●									
Check for stator shorted to ground.					●			●					
Check seat switch is plugged in and spring inside connector is good.												●	●

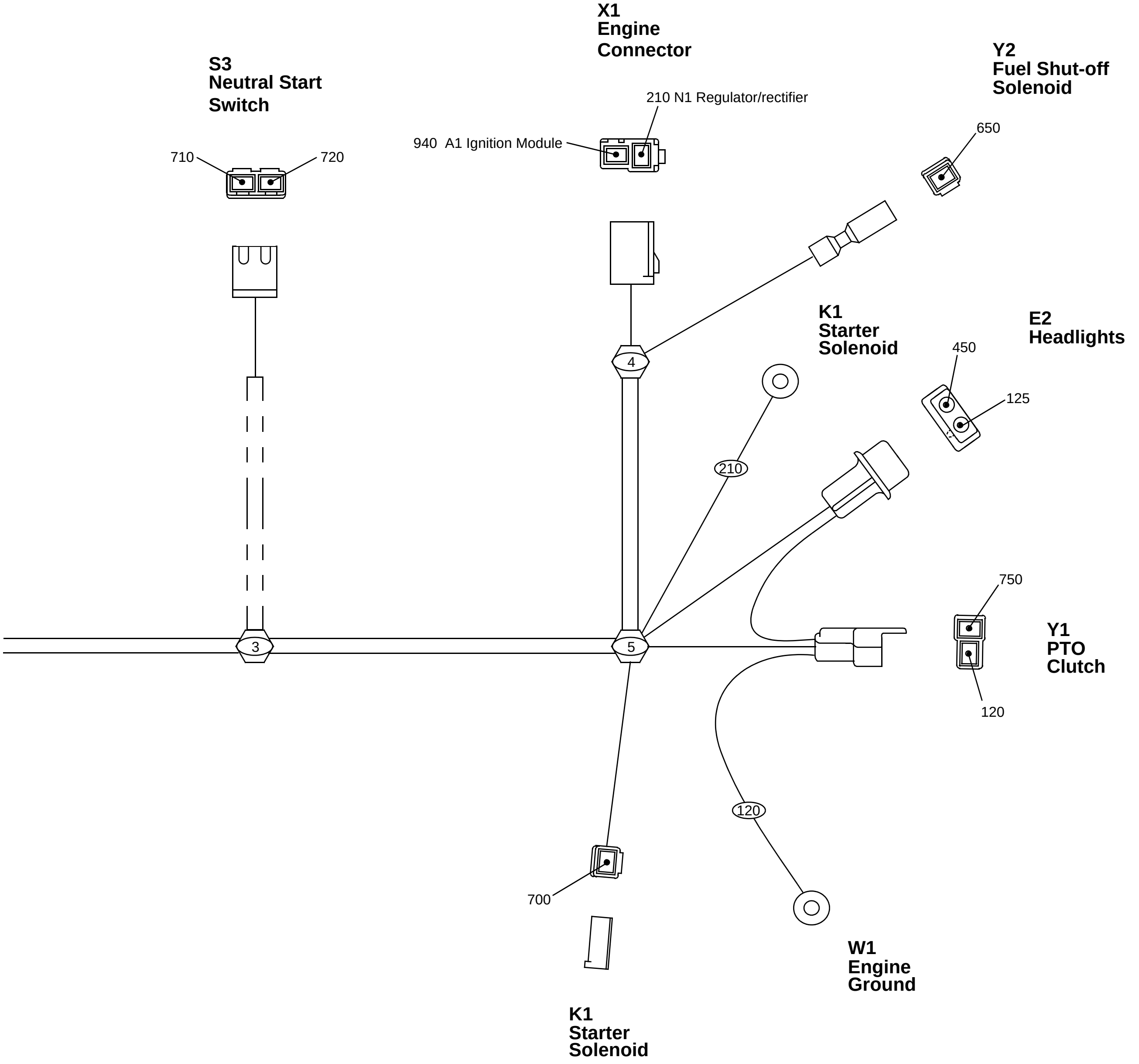
WIRING HARNESS DIAGRAMS

STX30 (SN 010001—135159) (SN 595001—750000)
STX38 (SN 010001—139615) (SN 595001—750000)

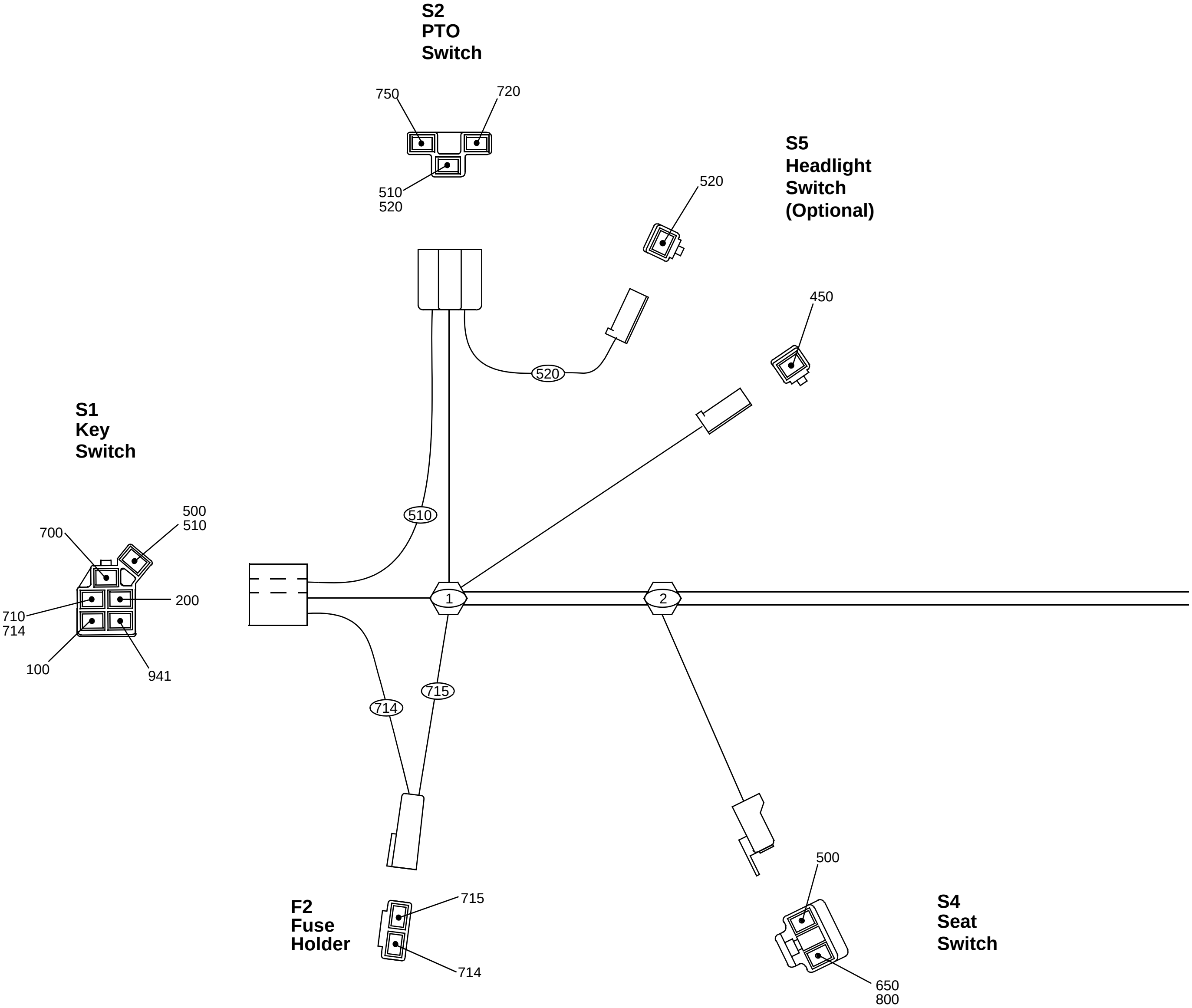


Circuit Number	Wire Size	Color	Termination Points
100	0.5	Blk	S1, Battery Ground
105	0.5	Blk	K2, S1
110	0.5	Blk	K2, K2
120	1.0	Blk	Y1, W2
125	1.0	Blk	E2, 120 Blk
200	1.0	Red	S1, F1
210	1.0	Red	K1, X1, N1
450	1.0	Yel/Wht	E2, S5
500	0.8	Yel	S1, S4
510	1.0	Yel	S2, S1
520	1.0	Yel	S2, S5

Circuit Number	Wire Size	Color	Termination Points
650	0.8	Brn	S4, Y2
700	0.8	Pur	S1, K1
710	0.8	Pur	S1, S3
714	0.8	Pur/Blk	S1, F2
715	0.5	Pur/Blk	F2, Diode
716	0.5	Diode	Diode, K2
720	0.8	Pur	S3, S2
750	1.0	Blu	S2, Y1
800	0.8	Pnk	S4, K2
940	0.5	Wht	S1, X1
941	0.5	Wht	K2, S1

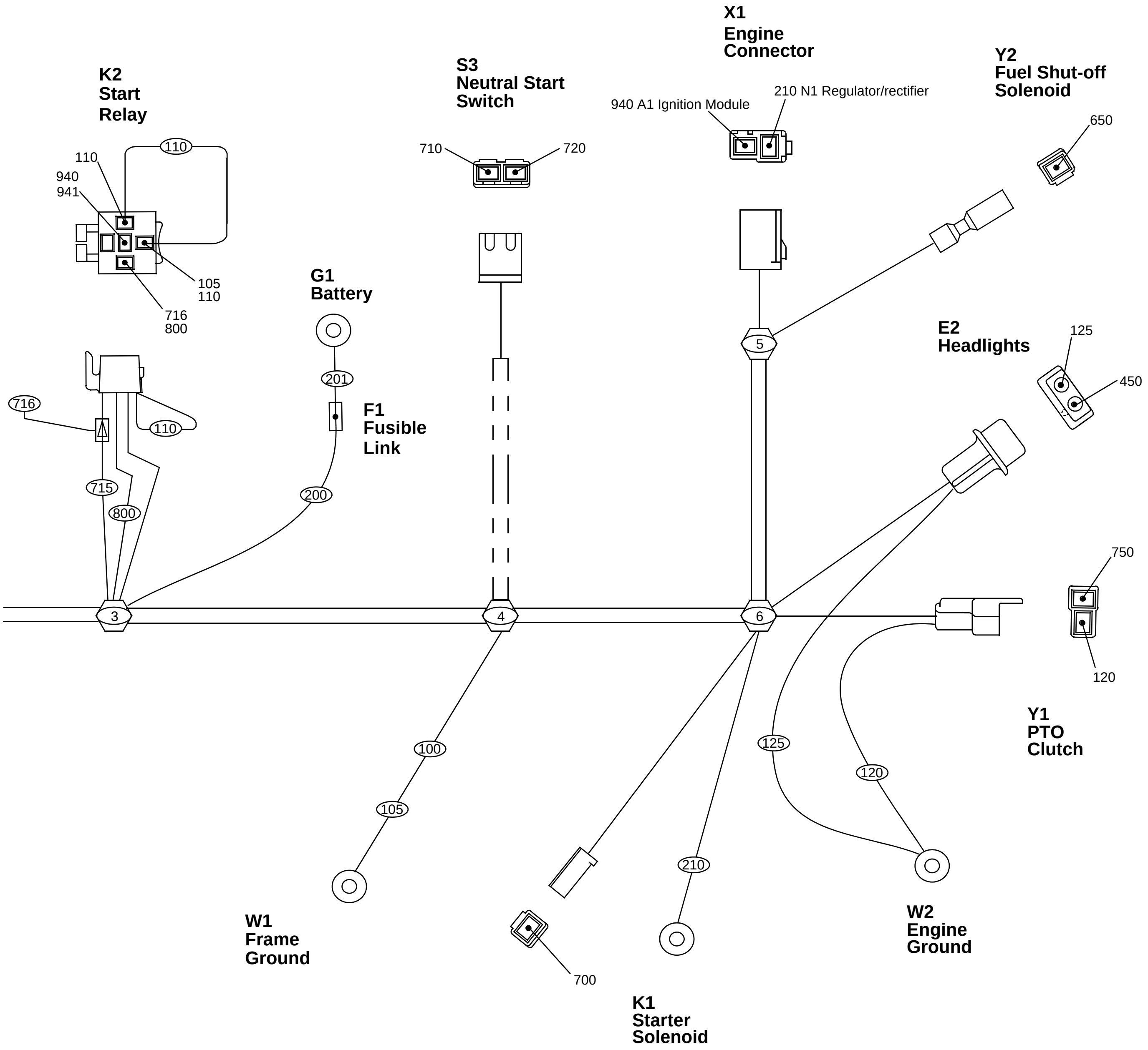

X1
Engine
Connector
210 N1 Regulator/rectifier
940 A1 Ignition Module
S3
Neutral Start
Switch
710
720
Y2
Fuel Shut-off
Solenoid
650
K1
Starter
Solenoid
E2
Headlights
450
125
4
210
750
Y1
PTO
Clutch
3
5
120
120
700
W1
Engine
Ground
K1
Starter
Solenoid

STX30 (SN 135160—160000)
STX38 (SN 139616—160000)

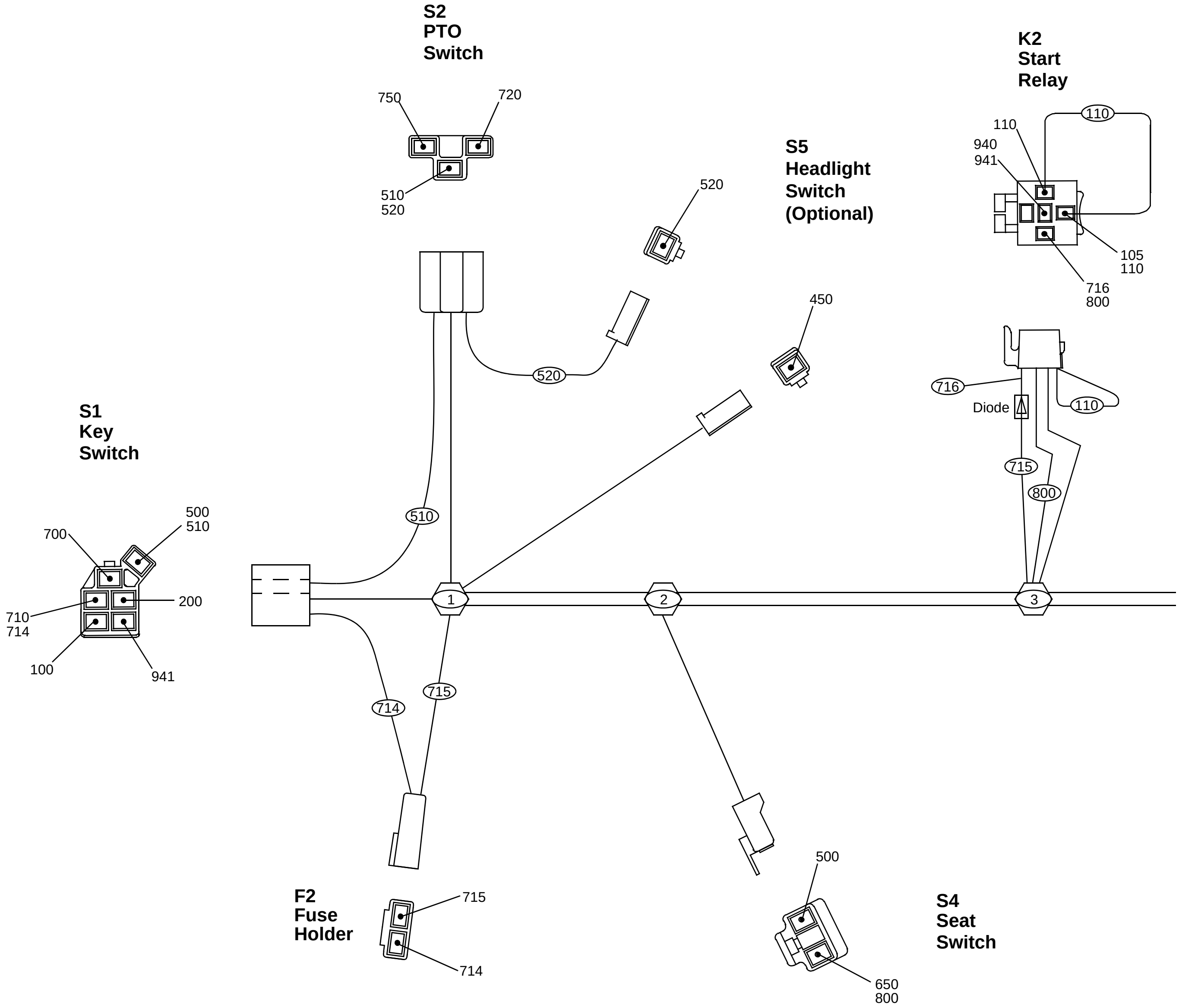


Circuit Number	Wire Size	Color	Termination Points
100	0.5	Blk	S1, W1
105	0.5	Blk	K2, W1
110	0.5	Blk	K2, K2
120	1.0	Blk	Y1, W2
125	1.0	Blk	E2, W2
130	0.8	Blk	K1, W1
200	1.0	Red	S1, F1
201	0.5	Red-Fuse	F1, G1
210	1.0	Red	K1, X1, N1
450	1.0	Yel/Wht	S5, E2
500	0.8	Yel	S1, S4

Circuit Number	Wire Size	Color	Termination Points
510	1.0	Yel	S2, S1
520	1.0	Yel	S2, S5
650	0.8	Brn	S4, Y2
700	0.8	Pur	S1, K1
710	0.8	Pur	S1, S3
714	0.8	Pur/Blk	S1, F2
715	0.5	Pur/Blk	F2, Diode, K2
716	0.5	Diode	Diode, K2
720	0.8	Pur	S2, S3
750	1.0	Blu	S2, Y1
800	0.8	Pnk	S4, K2
940	0.5	Wht	K2, A1, X1
941	0.5	Wht	K2, S1

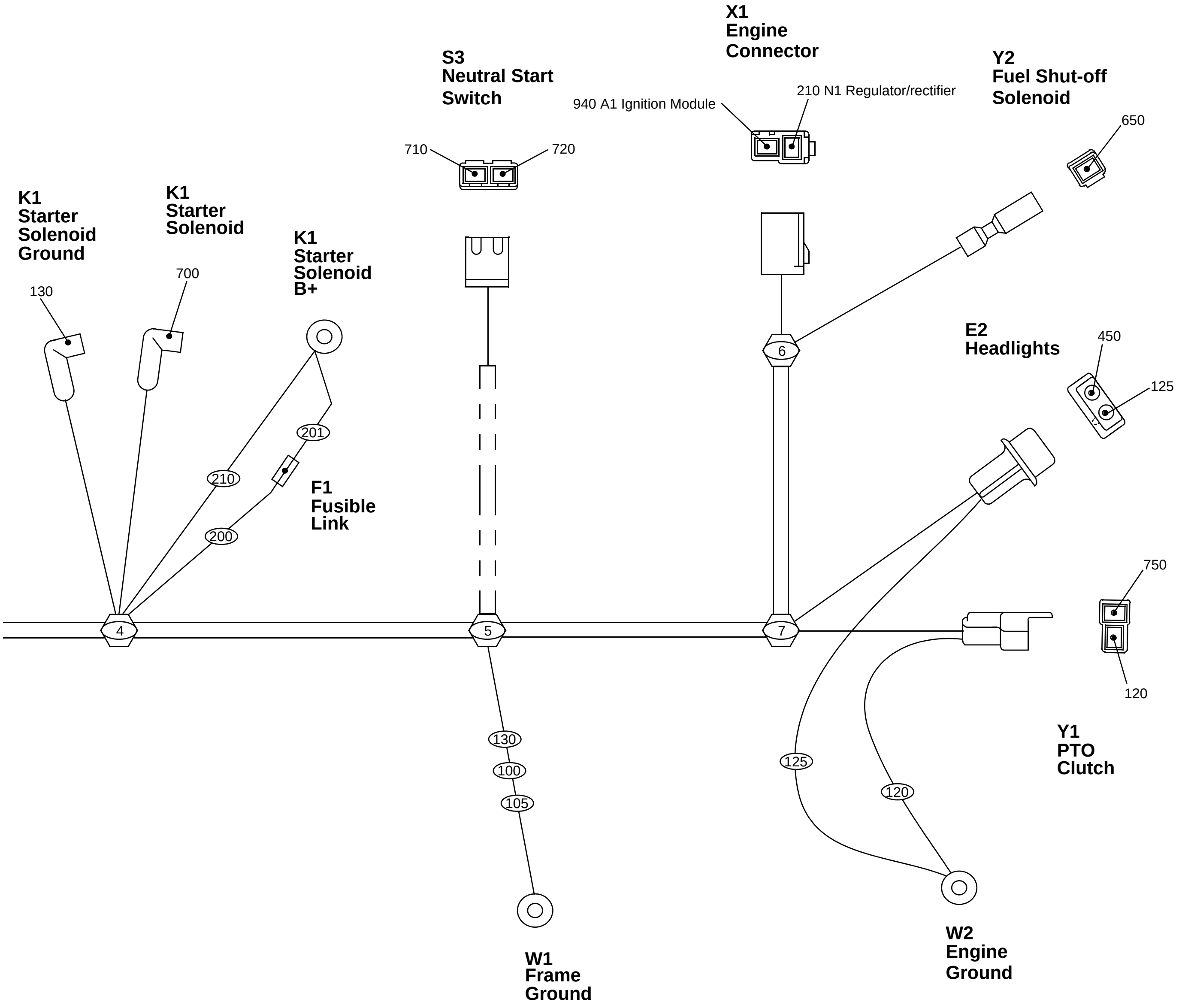

X1
Engine
Connector
940 A1 Ignition Module
210 N1 Regulator/rectifier
S3
Neutral Start
Switch
710
720
K2
Start
Relay
110
940
941
110
105
110
716
800
Y2
Fuel Shut-off
Solenoid
650
G1
Battery
201
F1
Fusible
Link
200
716
110
715
800
5
E2
Headlights
125
450
750
3
4
6
120
Y1
PTO
Clutch
100
105
125
120
210
W1
Frame
Ground
700
K1
Starter
Solenoid
W2
Engine
Ground

STX38 (SN 160001—210000)



Circuit Number	Wire Size	Color	Termination Points
100	0.5	Blk	S1, W1
105	0.5	Blk	K2, W1
110	0.5	Blk	K2, K2
120	1.0	Blk	Y1, W2
125	1.0	Blk	E2, W2
130	0.8	Blk	K1, W1
200	1.0	Red	S1, F1
201	0.5	Red-Fuse	F1, K1
210	1.0	Red	K1, X1, N1
450	1.0	Yel/Wht	S6, S5
500	0.8	Yel	S1, S4

Circuit Number	Wire Size	Color	Termination Points
510	1.0	Yel	S2, S1
520	1.0	Yel	S2, S5
650	0.8	Brn	S4, Y2
700	0.8	Pur	S1, K1
710	0.8	Pur	S1, S3
714	0.8	Pur/Blk	S1, F2
715	0.5	Pur/Blk	F2, Diode, K2
716	0.5	Diode	Diode, K2
720	0.8	Pur	S2, S3
750	1.0	Blu	S2, Y1
800	0.8	Pnk	S4, K2
940	0.5	Wht	K2, X1, A1
941	0.5	Wht	K2, S1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S3
Neutral Start
Switch
940 A1 Ignition Module
210 N1 Regulator/rectifier
Y2
Fuel Shut-off
Solenoid
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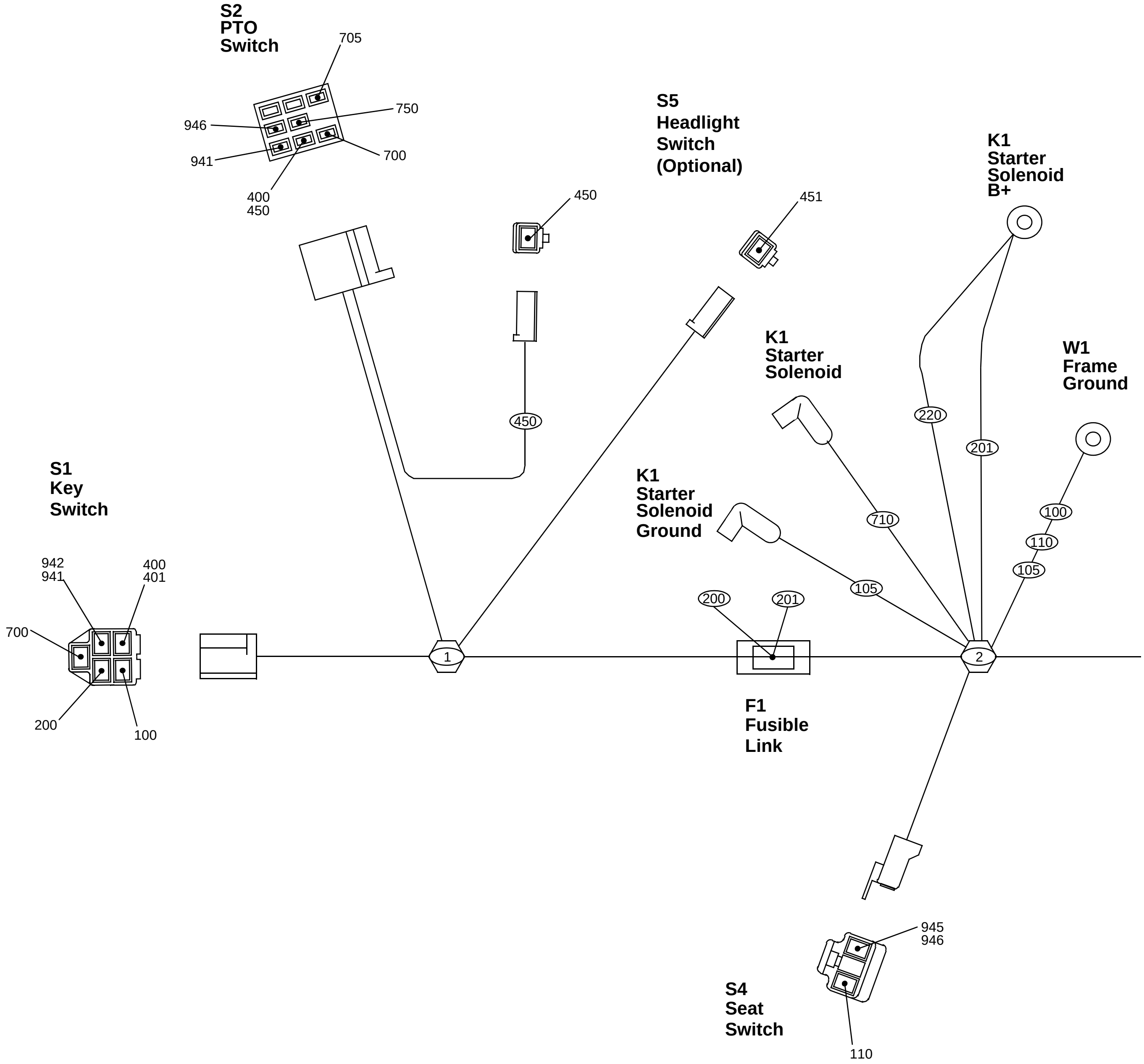
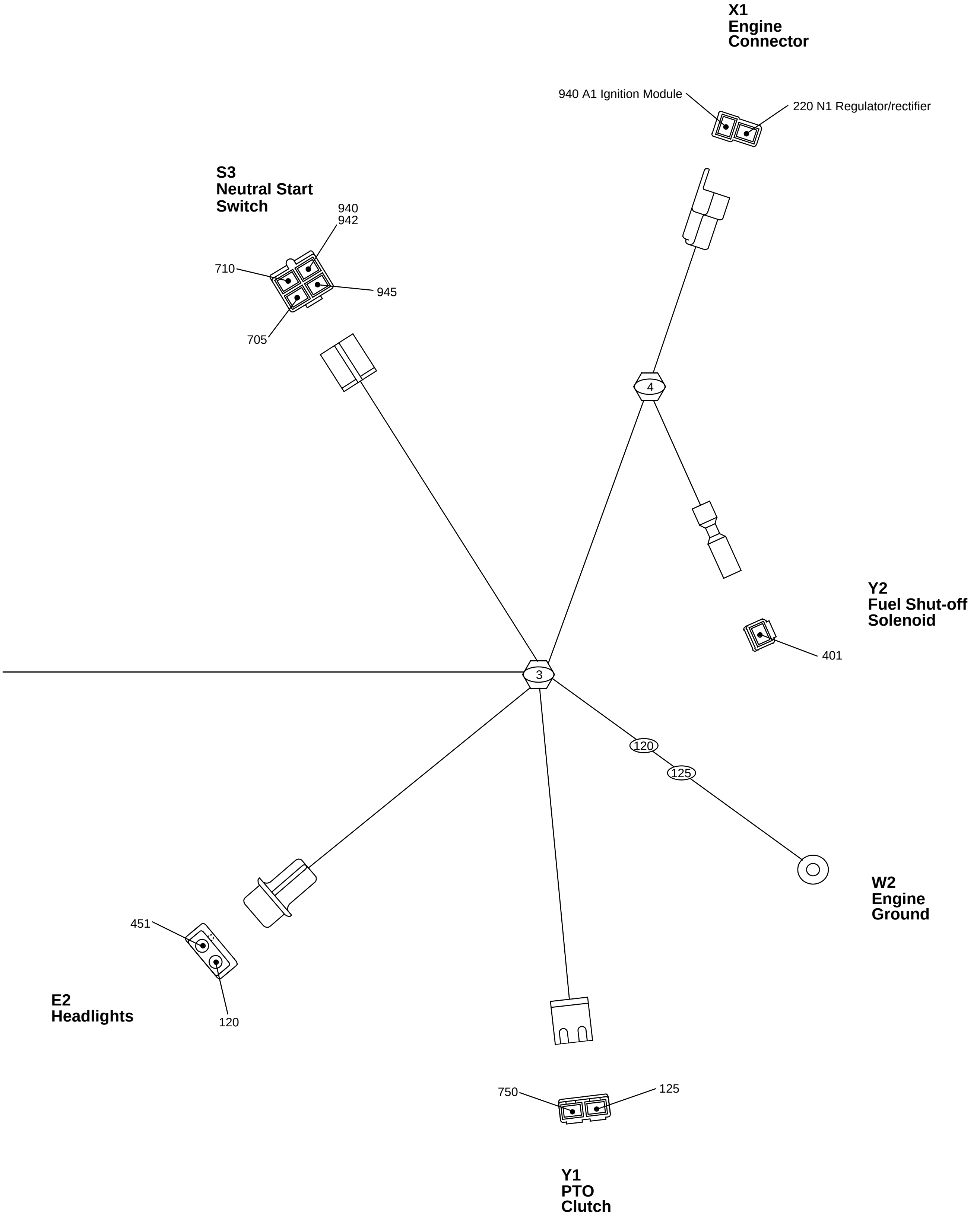
710
720
K1
Starter
Solenoid
Ground
K1
Starter
Solenoid
K1
Starter
Solenoid
B+
700
130
6
E2
Headlights
450
125
201
210
F1
Fusible
Link
200
750
4
5
7
120
Y1
PTO
Clutch
130
100
105
125
120
W1
Frame
Ground
W2
Engine
Ground

STX38 (SN 210001—)
STX46 (SN 240001—)



Circuit Number	Wire Size	Color	Termination Points
100	1.0	Blk	S1, W1
105	1.0	Blk	K1, W1
110	0.5	Blk	W1, S4
120	0.8	Blk	E2, W2
125	0.8	Blk	Y1, W2
200	0.8	Red	S1, F1
201	0.5	Lt Org-Fuse	F1, K1
220	0.8	Red	K1, X1, N1
400	0.8	Yel	S1, S2
401	0.5	Yel	Y2, S1

Circuit Number	Wire Size	Color	Termination Points
450	0.8	Yel/Wht	S5, S2
451	0.8	Yel/Wht	E2, S5
700	0.8	Pur	S1, S2
705	0.8	Pur/Wht	S2, S3
710	0.8	Pur	K1, S3
750	0.8	Blu	S2, Y1
940	1.0	Wht	S3, X1, A1
941	1.0	Wht	S2, S1
942	0.5	Wht	S3, S1
945	0.5	Wht/Blk	S4, S3
946	0.5	Wht/Blk	S4, S2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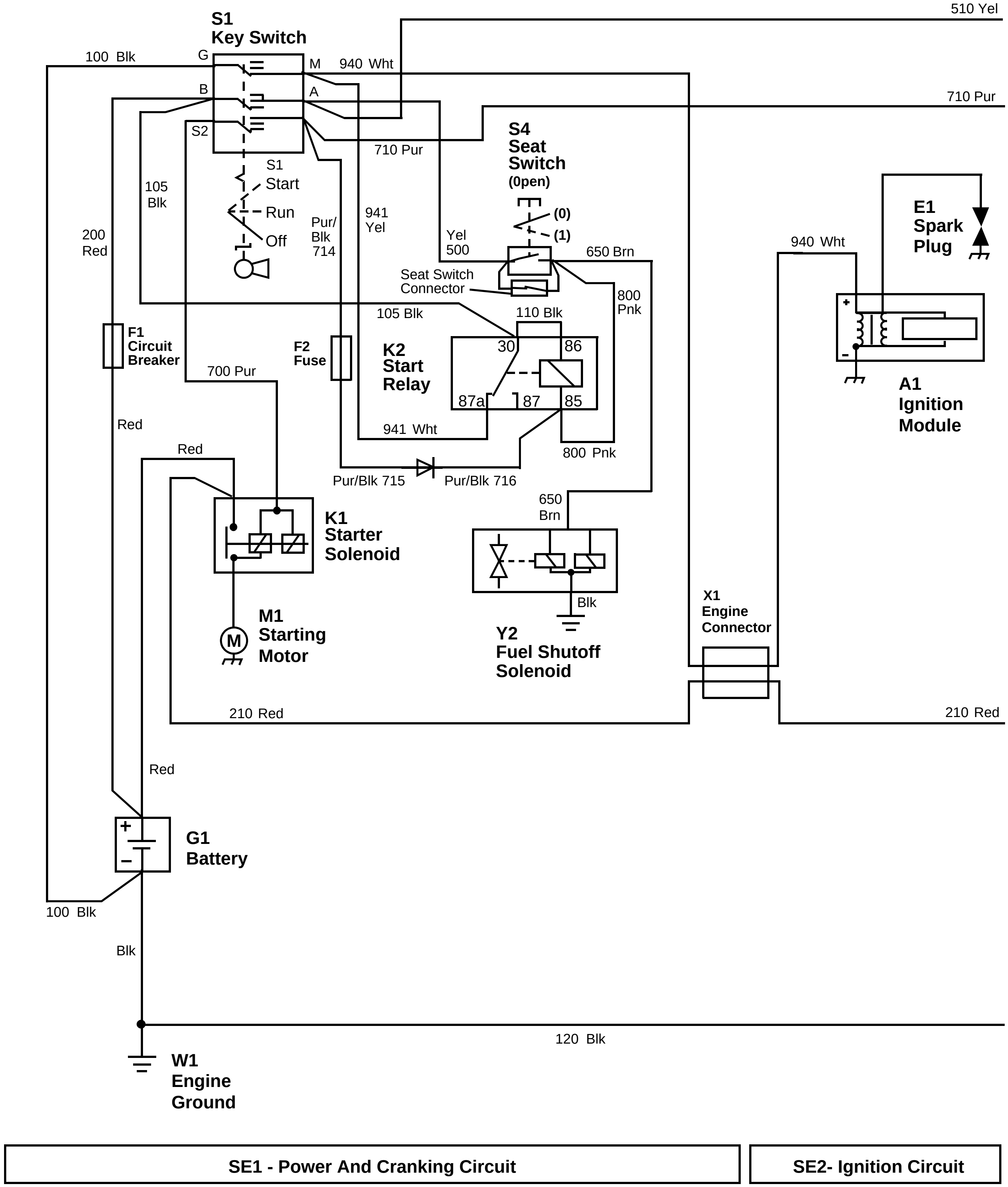
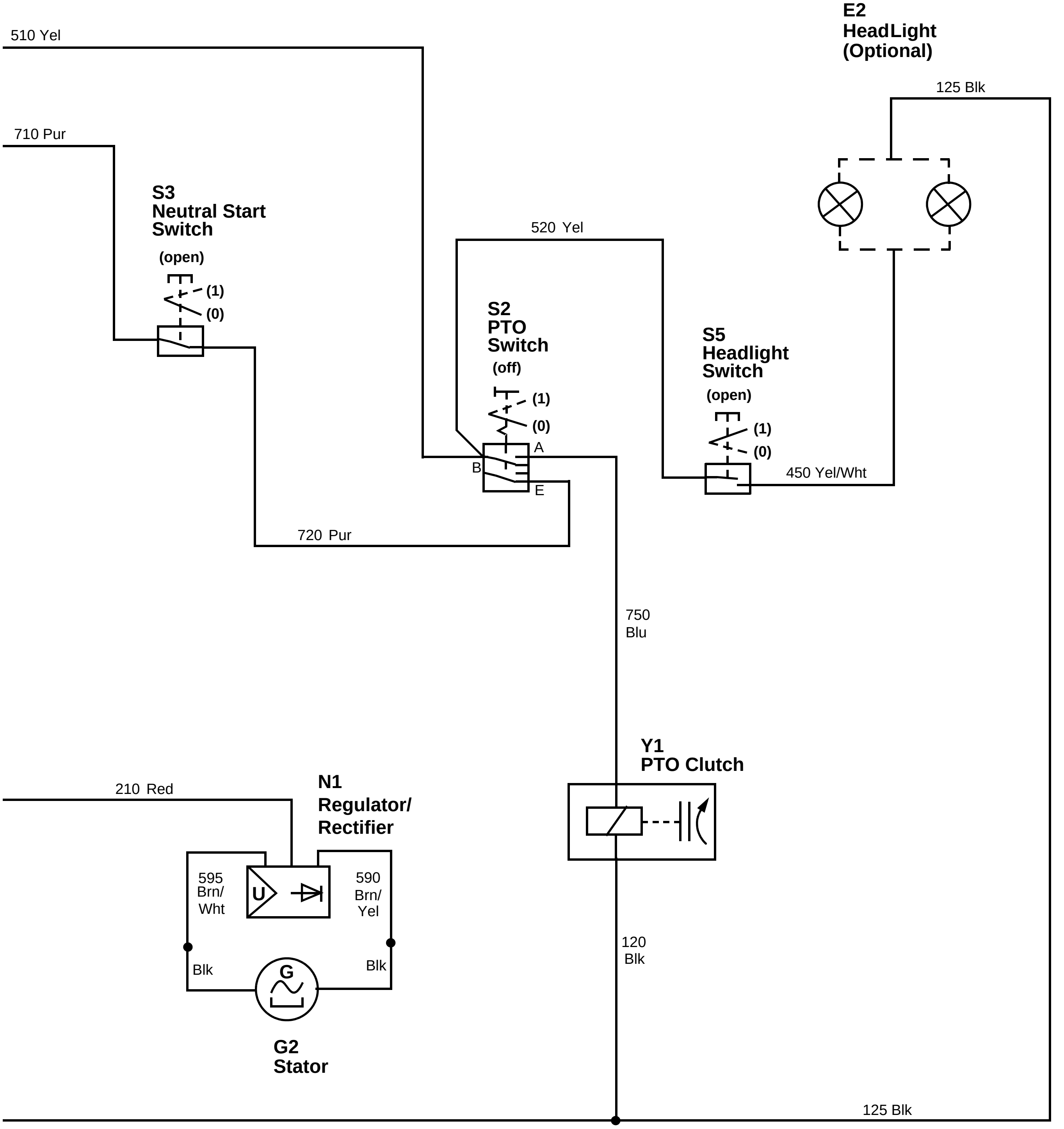
Connector
940 A1 Ignition Module
220 N1 Regulator/rectifier
S3
Neutral Start
Switch
940
942
710
945
705
4
Y2
Fuel Shut-off
Solenoid
401
3
120
125
W2
Engine
Ground
451
E2
Headlights
120
750
125
Y1
PTO
Clutch

WIRING SCHEMATICS

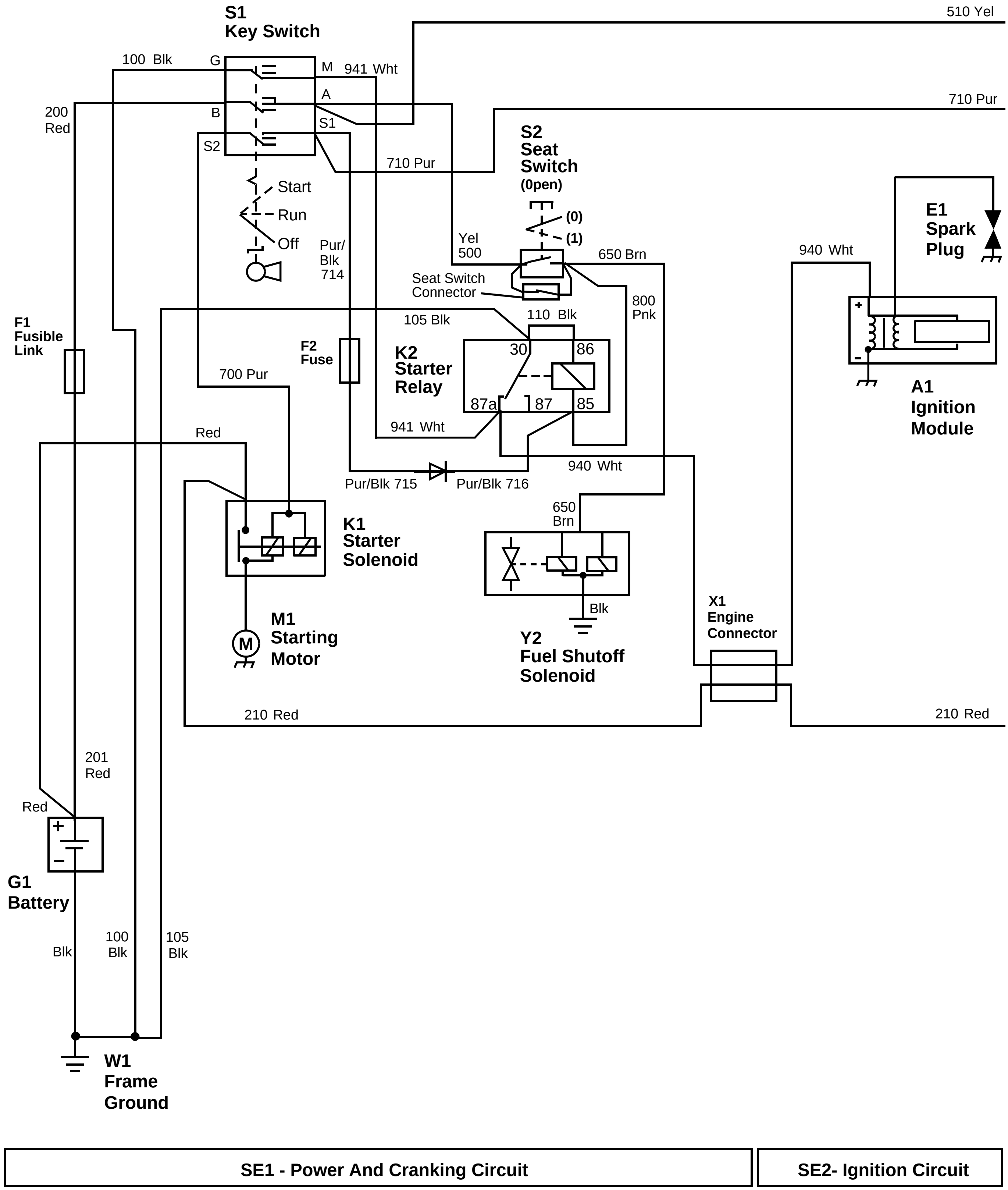
STX30 (SN 010001—135159) (SN 595001—750000)
STX38 (SN 010001—139615) (SN 595001—750000)

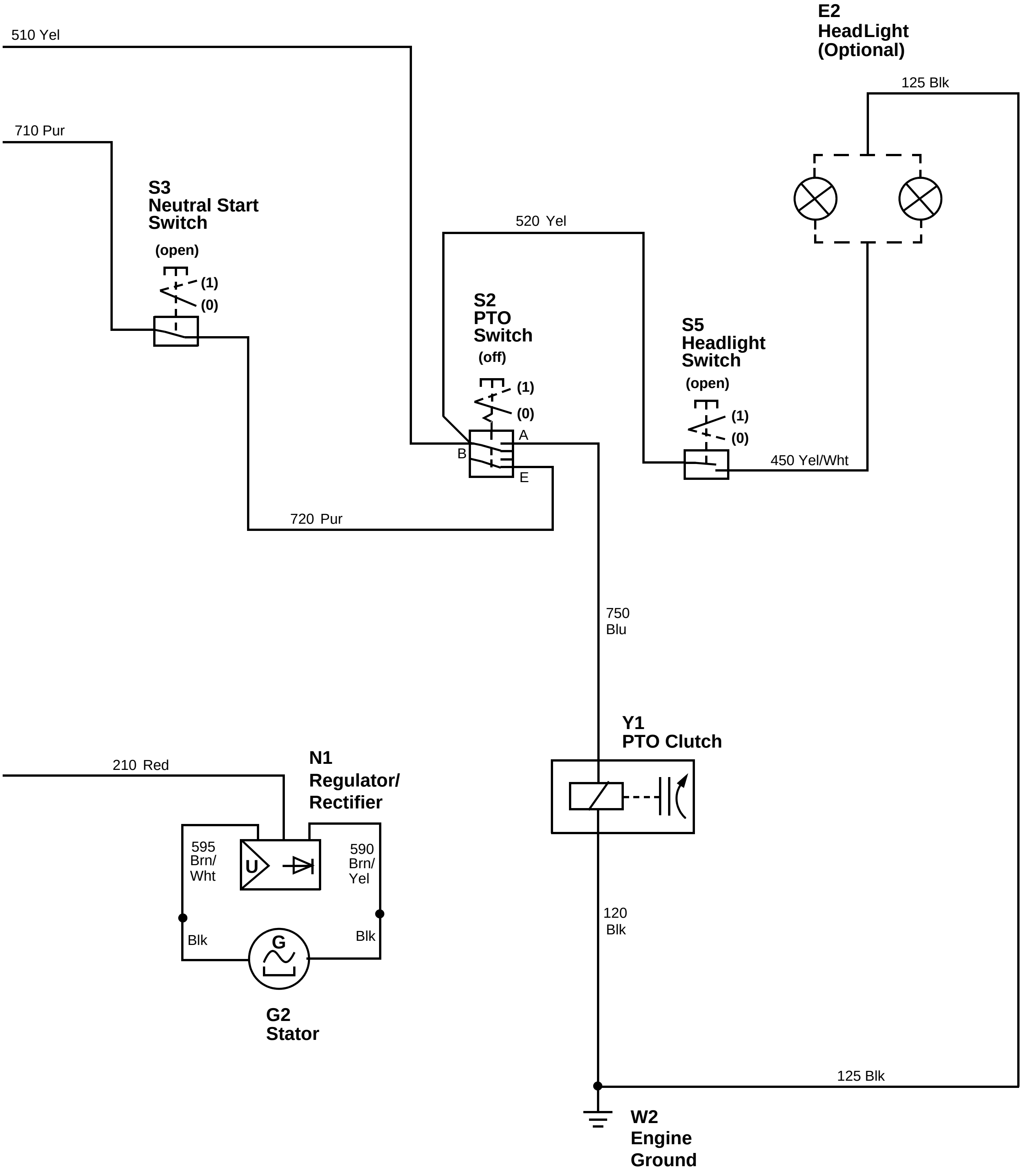




SE3 - Charging Circuit	SE4 - Neutral Start And PTO Circuit	SE5 - Headlights (Optional)

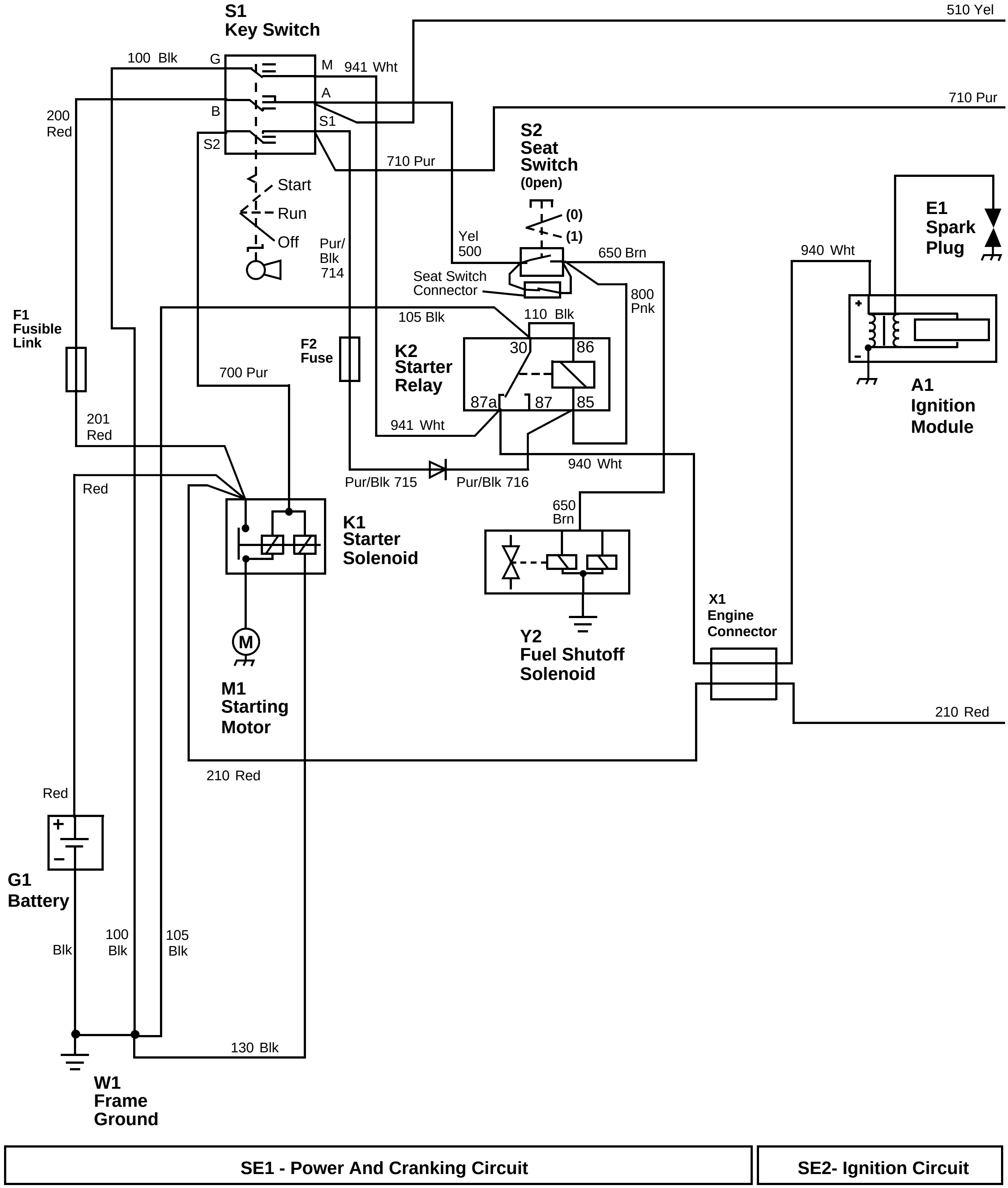
STX30 (SN 135160—160000)
STX38 (SN 139616—160000)

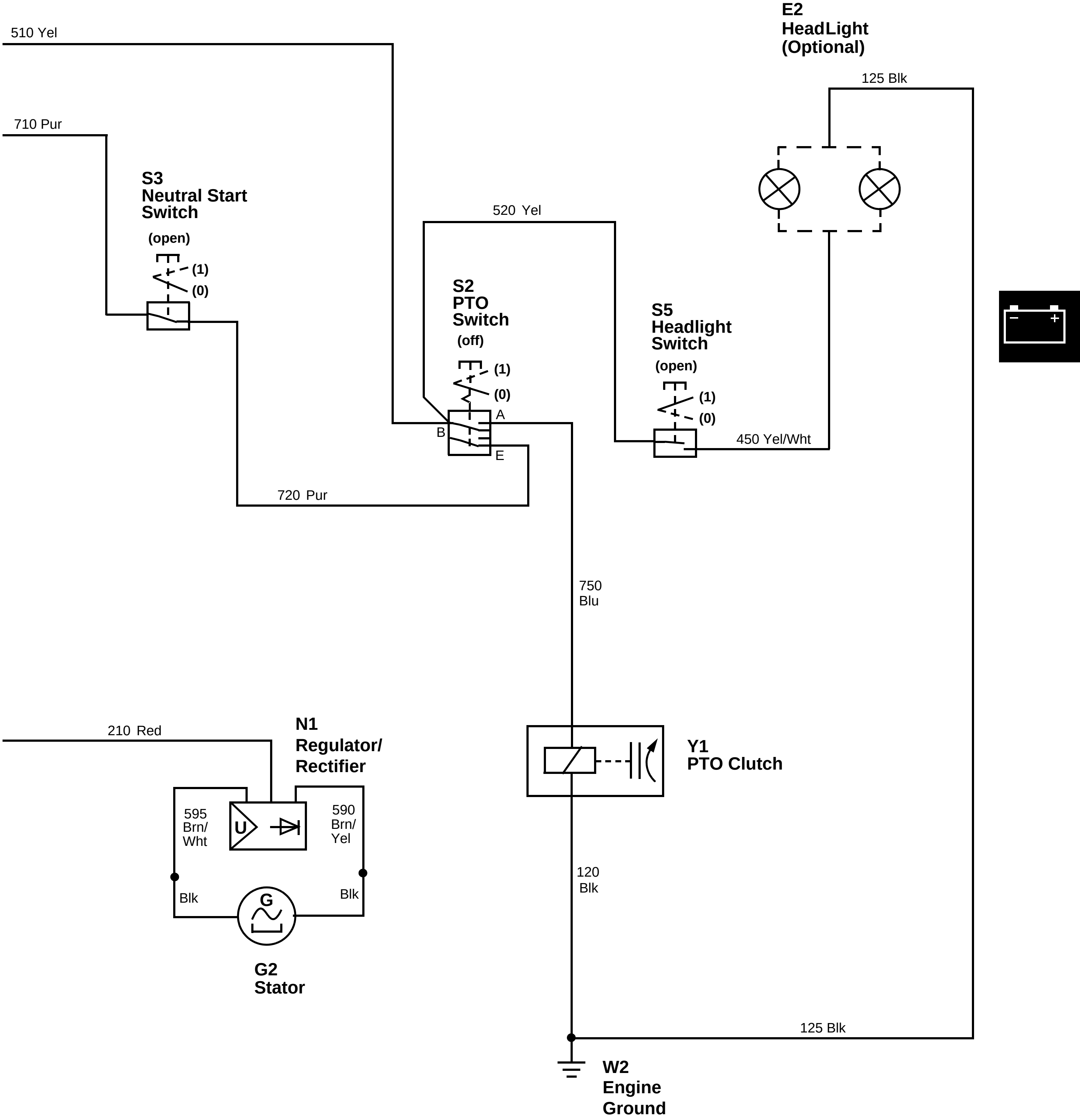




SE3 - Charging Circuit	SE4 - Neutral Start And PTO Circuit	SE5 - Headlights (Optional)

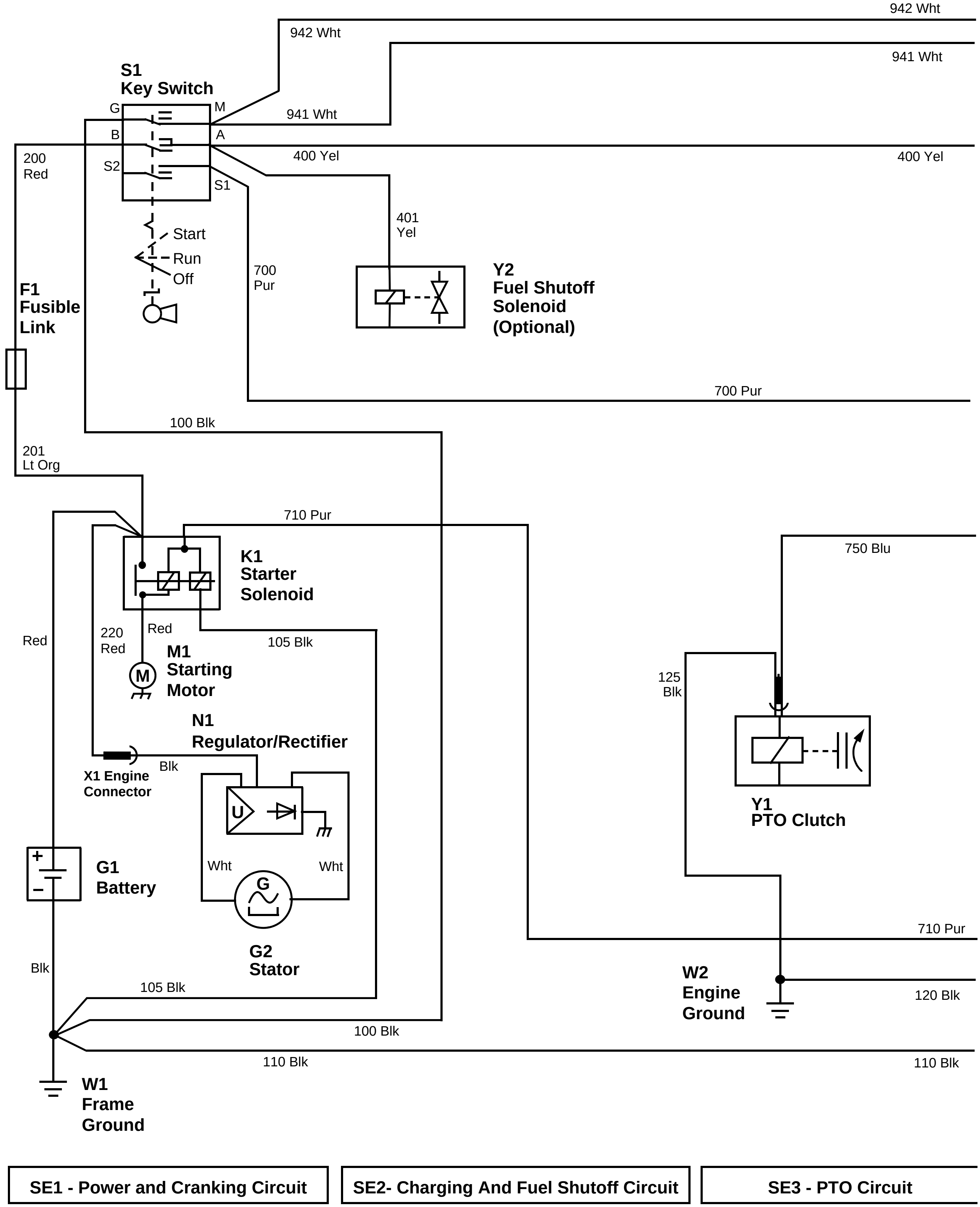
STX38 (SN 160001—210000)

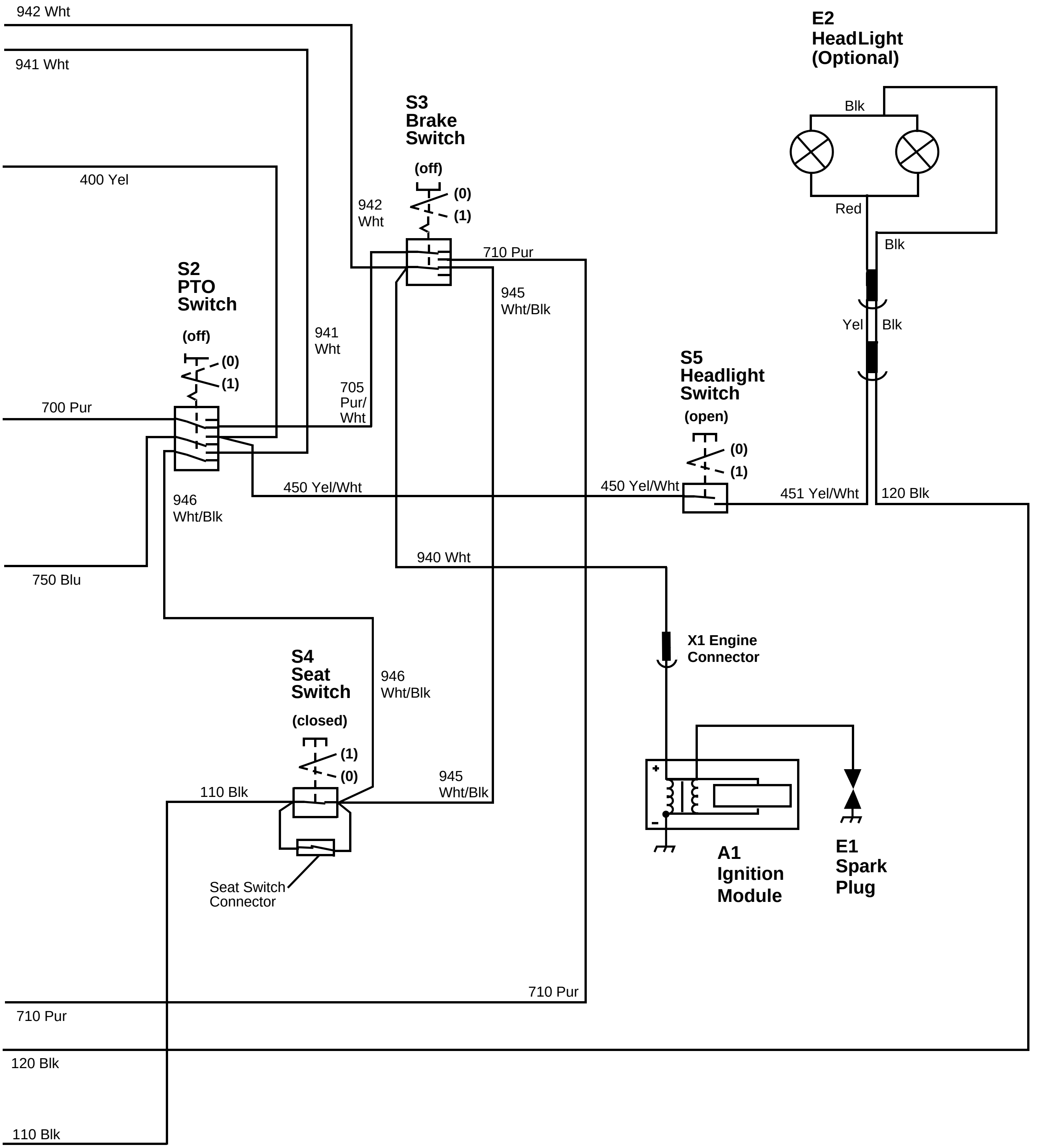




SE3 - Charging Circuit	SE4 - Neutral Start And PTO Circuit	SE5 - Headlights (Optional)

STX38 (SN 210001—)
STX46 (SN 240001—)





SE3 - PTO Circuit	SE4 - Ignition Circuit	SE5 - Headlights (Optional) Circuit

CIRCUIT OPERATION AND DIAGNOSIS

CRANKING CIRCUIT OPERATION STX30 & STX38 (SN —210000)

Function:

The cranking system is used to energize the starting motor.

Operating Conditions:

In order to crank the engine; the key switch must be in the START position, the PTO switch must be OFF, and the transaxle must be in neutral. The operator DOES NOT have to be on the seat to crank the engine.

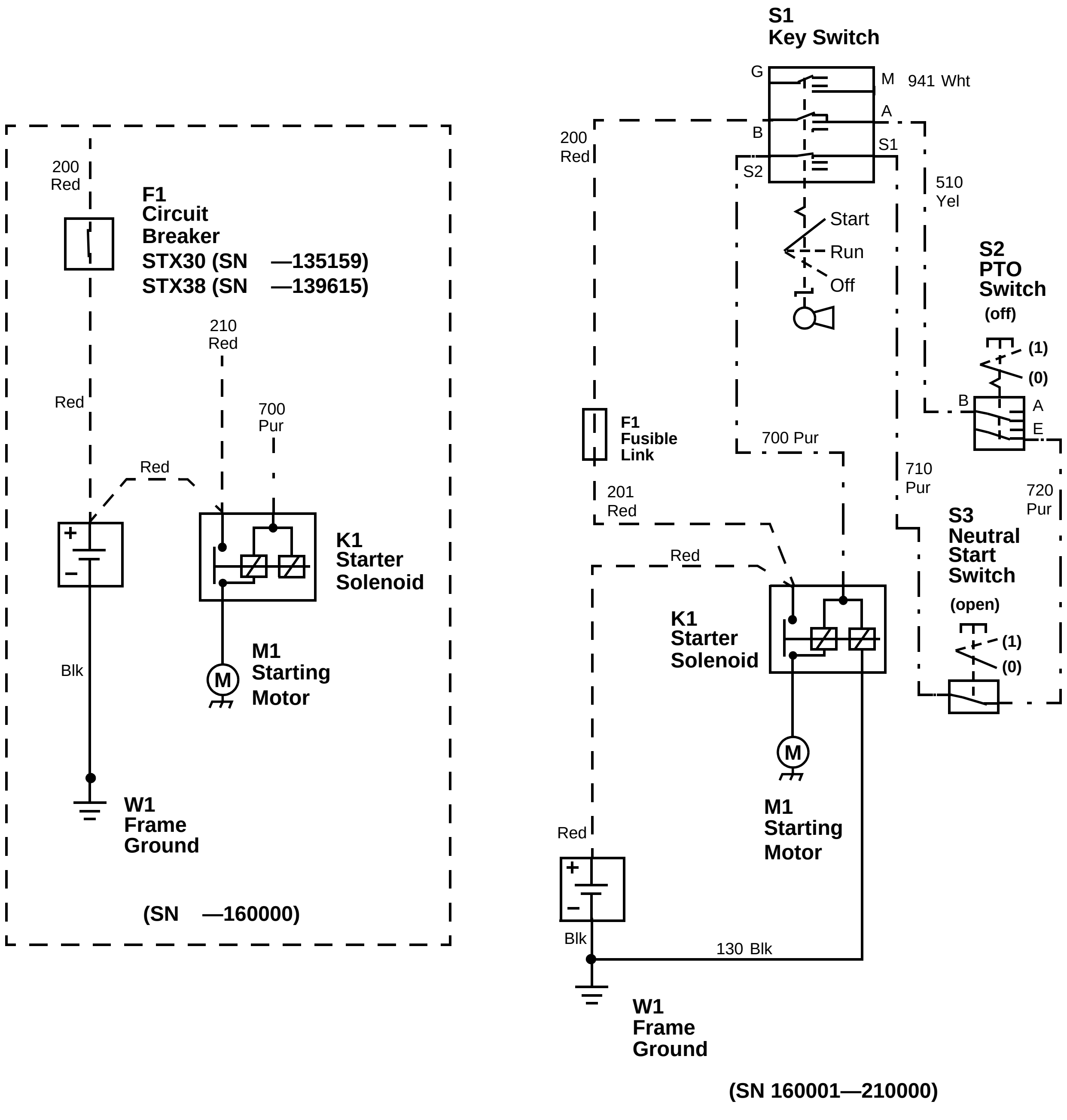
Theory of Operation:

For units up to (SN —160000) the starting motor is a solenoid shift design. For units (SN 160001—), the starting motor has a separate starter solenoid. Current flows from the battery (G1) positive terminal to the starter solenoid (K1) battery terminal, fusible link or circuit breaker (F1), and key switch (S1) in the START position, current flows to the PTO switch (S2).

The PTO switch is used in the neutral start circuit to prevent the engine from cranking if the PTO is engaged. With the PTO switch closed (PTO disengaged), current flows to the neutral start switch (S3).

The neutral start switch is located in the top of the transaxle directly over the shift fork. When the shift fork is in the neutral position, the switch is closed. The neutral start switch is used to prevent the engine from cranking if the transaxle is in gear. With the neutral start switch closed, current flows to the key switch S1—S2 terminals and starter solenoid, engaging the solenoid. The solenoid is engaged by current flowing through both pull-in and hold-in windings, pulling the plunger inward. The plunger closes the solenoid main contacts. When the main contacts are closed, both ends of the pull-in windings have the same voltage so current through the pull-in windings stops. Current continues through the hold-in windings, keeping the solenoid engaged.

With the solenoid main contacts closed, high current from the battery flows across the main contacts to the starter motor (M1) causing it to turn.



Ground ———— Power – – – – – Control — · — · —

SE1 - Cranking Circuit Operation

CRANKING CIRCUIT DIAGNOSIS
STX30 & STX38 (SN —210000)

Test Conditions:

- Transaxle in neutral
- Park brake engaged
- PTO switch disengaged
- Key switch in run position
- Meter negative (-) lead on battery negative (-) terminal
- Meter positive (+) lead on numbered test point

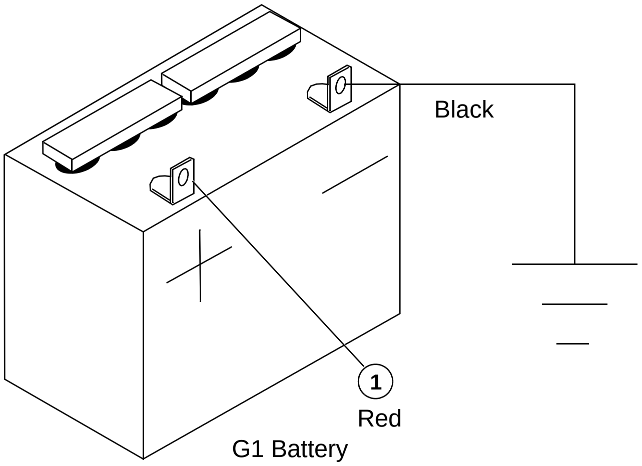
Test/Check Point	Normal	If Not Normal
1. Battery positive terminal.	11.8—13.2	Test battery.
2. Key switch terminal B.	Battery voltage	Check battery cable connection, fusible link or circuit breaker and 210/201 red wire.
3. Key switch terminal A.	Battery voltage	Replace key switch.
4. PTO switch yellow wire.	Battery voltage	Test 510 yellow wire.
5. PTO switch purple wire.	Battery voltage	Replace PTO switch.
6. Neutral start switch 720 pur wire.	Battery voltage	Test purple wire.
7. Neutral start switch 710 pur wire.	Battery voltage	Replace neutral start switch.
8. Key switch terminal S1.	Battery voltage	Test purple wire.

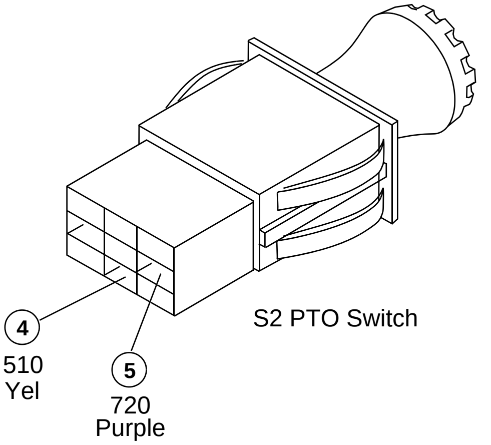
Test Conditions:

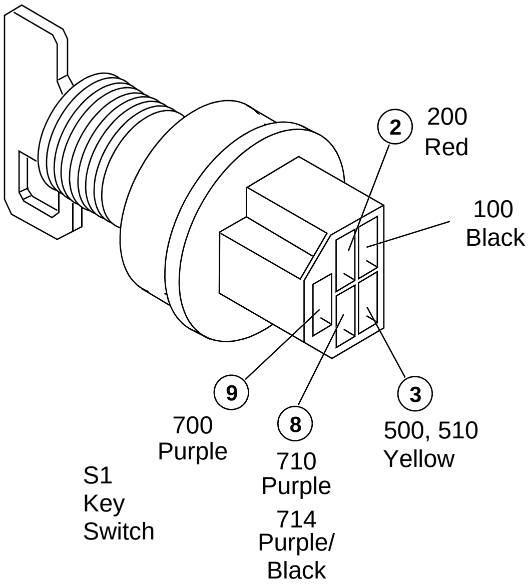
- Key switch in start position

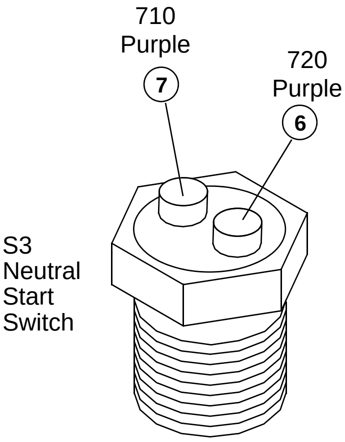
Test/Check Point	Normal	If Not Normal
9. Key switch terminal S2.	Battery voltage	Replace key switch.
10. Starter solenoid terminal S.	Battery voltage	Test purple wire.
11. Starter solenoid ground terminal.	Greater than 0—less than 0.2 volts.	Greater than 0.2 volts—check starter solenoid ground circuit and 130 Blk wire. 0.0 volts—Replace starter solenoid.
12. Starting motor	Battery voltage	Check red wire, if OK test starting motor.

CRANKING CIRCUIT TEST POINTS STX30 & STX38 (SN —210000)

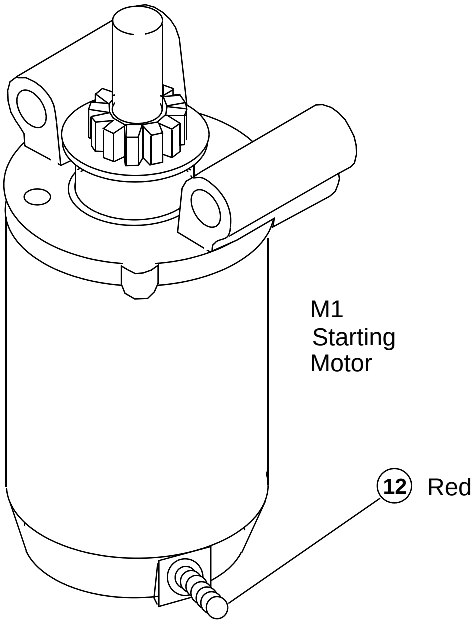


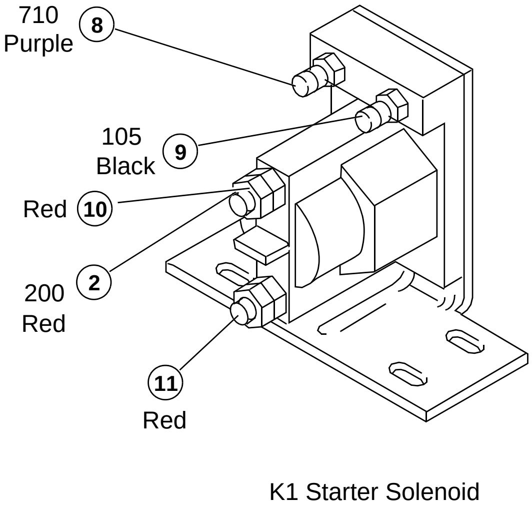






Late Model STX38 & STX46—
S3 switch is labeled brake switch





CRANKING CIRCUIT OPERATION STX38 (SN 210001—) & STX46

Function:

The cranking system is used to energize the starting motor.

Operating Conditions:

In order to crank the engine; the key switch must be in the START position, the PTO switch must be OFF, and the brake must be ENGAGED. The operator DOES NOT have to be on the seat to crank the engine.

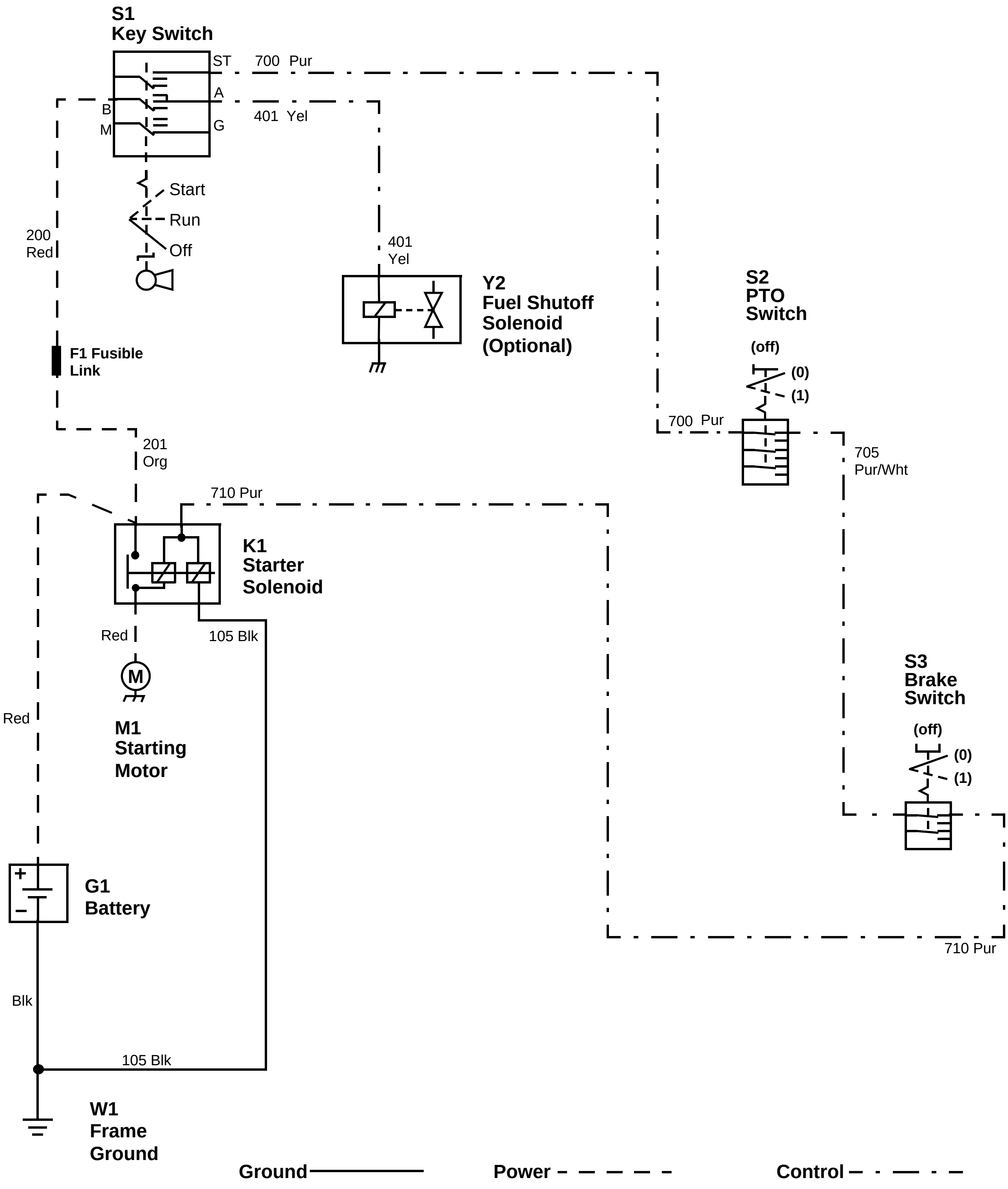
Theory of Operation:

The starting motor has a separate starter solenoid. Current flows from the battery (G1) positive terminal to the starter solenoid (K1), fusible link (F1), and key switch (S1). With the key switch in the START position, current flows to the PTO switch (S2) and the optional fuel shut-off solenoid (Y2), causing the solenoid plunger to unseat and allow fuel to flow into the venturi of the carburetor.

The PTO switch (S2) is used in the neutral start circuit to prevent the engine from cranking IF the PTO switch is ENGAGED. When the PTO switch is OFF (PTO disengaged), current flows to the brake switch (S3).

The brake switch (S3) is located under the right side of the chassis and aligned with the brake pedal bell crank. When the brake pedal is in the ENGAGED position, the bell crank depresses the brake switch (S3) plunger and the two unmarked terminals (normally opened) are closed, providing a path for current to flow to the starter solenoid (K1). With the small windings being energized, the solenoid plunger closes the large main terminals, supplying high battery current to the starter motor (M1), engaging the bendix drive with the engine flywheel, cranking the engine until the ignition circuit fires (see Ignition Circuit Operation), igniting the fuel/air mixture and starting the engine. Once the engine starts, the operator releases the key and key switch (S1) moves into RUN position. This breaks the current flow to the starter solenoid (K1) plunger small windings, opening the large main terminal and cutting off high battery current to the starter motor.

The brake switch (S3) is also used to prevent the engine from cranking if the drive train is engaged. This is accomplished through the clutching linkage in the gear models and the neutral return linkage in the hydro models working in conjunction with the brake pedal operation. With the brake pedal engaged, the brake switch (S3) operation described above is repeated



SE1 - CRANKING

CRANKING CIRCUIT DIAGNOSIS STX38 (SN 210001—) & STX46

Test Conditions:

- Transaxle/hydro in neutral
- PTO switch disengaged
- Meter negative (-) lead on battery negative (-) terminal
- Park brake engaged
- Key switch in run position
- Meter positive (+) lead on numbered test point

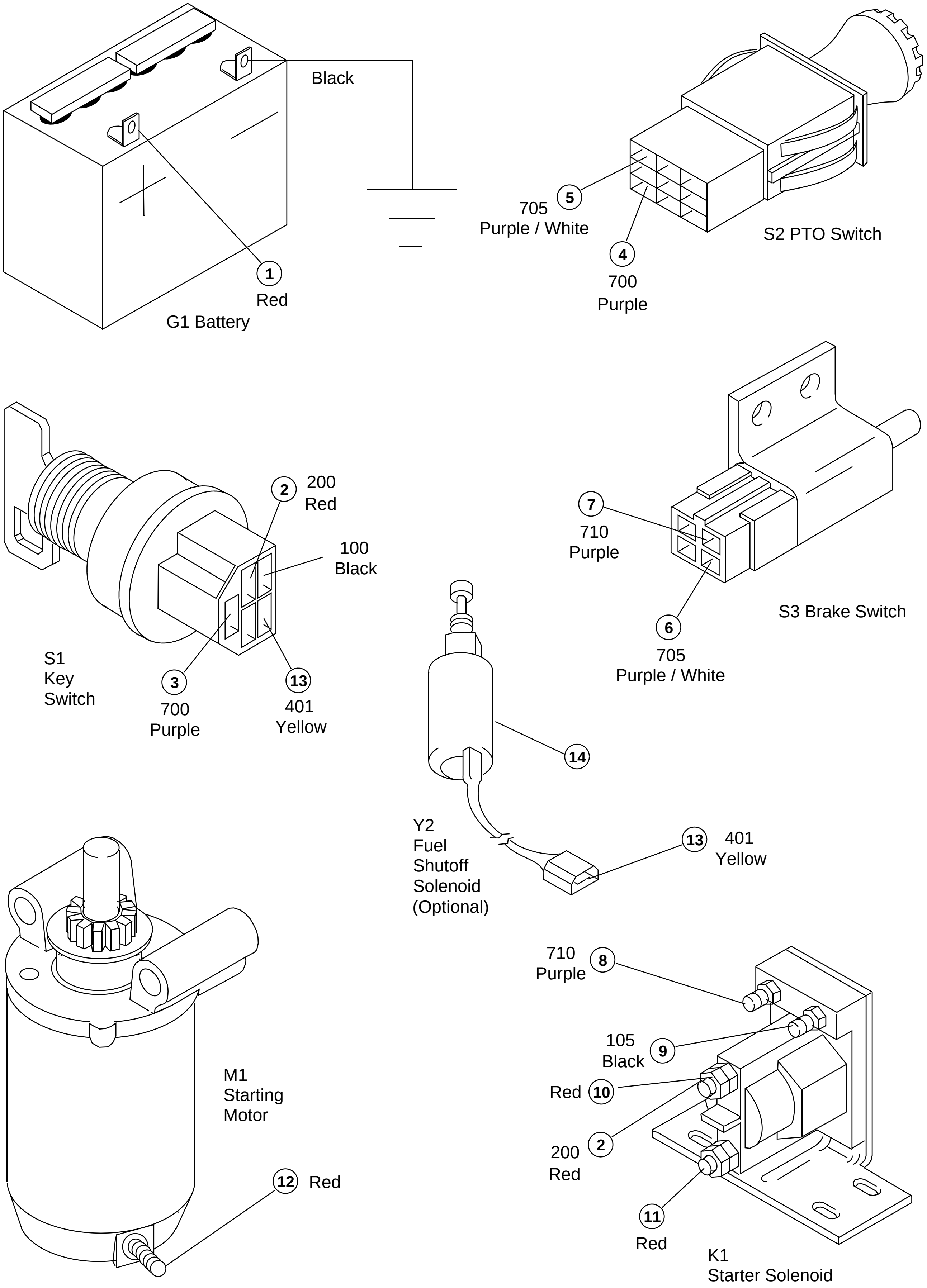
Test/Check Point	Normal	If Not Normal
1. Battery positive terminal	11.8—13.2 volts	Test battery
2. Key switch terminal B—200 red wire and starter solenoid terminal—200 red wire	Battery voltage	Check battery cable connection, fusible link (orange wire) and 200 red wires, replace as necessary.

Test Conditions:

- Key switch in start position

Test/Check Point	Normal	If Not Normal
3. Key switch terminal ST—700 purple wire.	Battery voltage	Replace key switch.
4. PTO switch—700 purple wire.	Battery voltage	Test 700 purple wire.
5. PTO switch—705 purple/ white wire.	Battery voltage	Replace PTO switch.
6. Brake interlock switch—705 purple/white wire.	Battery voltage	Test purple/white wire.
7. Brake interlock switch—710 purple wire.	Battery voltage	Replace brake interlock switch.
8. Starter solenoid terminal.	Battery voltage	Test 710 purple wire.
9. Starter solenoid ground terminal.	Greater than 0.0 —less than 0.2 volts	Greater than 0.2 volts— check starter solenoid ground circuit 105 blk wire; 0.0 volts, replace solenoid.
10. Starter solenoid battery terminal.	Battery voltage	Test red battery wire.
11. Starter solenoid starter terminal.	Battery voltage	Replace starter solenoid.
12. Starting motor	Battery voltage	Check red wire; if OK, test starter.
13. Fuel shut-off solenoid (optional)—401 yellow wire Key switch terminal A —401 yellow wire.	Battery voltage Battery voltage	Check yellow wire; if OK, test fuel shut-off solenoid. Replace key switch.
14. Fuel shut-off solenoid (optional).	Greater than 0.0—less than 0.2 volts.	Greater than 0.2 volts— check engine ground; if 0.0 volts, replace fuel shut-off solenoid.

CRANKING CIRCUIT TEST POINTS STX38 (SN 210001—) & STX46



IGNITION CIRCUIT OPERATION STX30 & STX38 (SN —210000)

Function:

To create a spark that ignites the fuel/air mixture in the engine.

Operating Conditions:

To produce a spark the key switch must be in the run or start position, and the operator must be ON the seat or with the operator OFF the seat, the PTO switch must be off and the transaxle must be in neutral.

Theory of Operation:

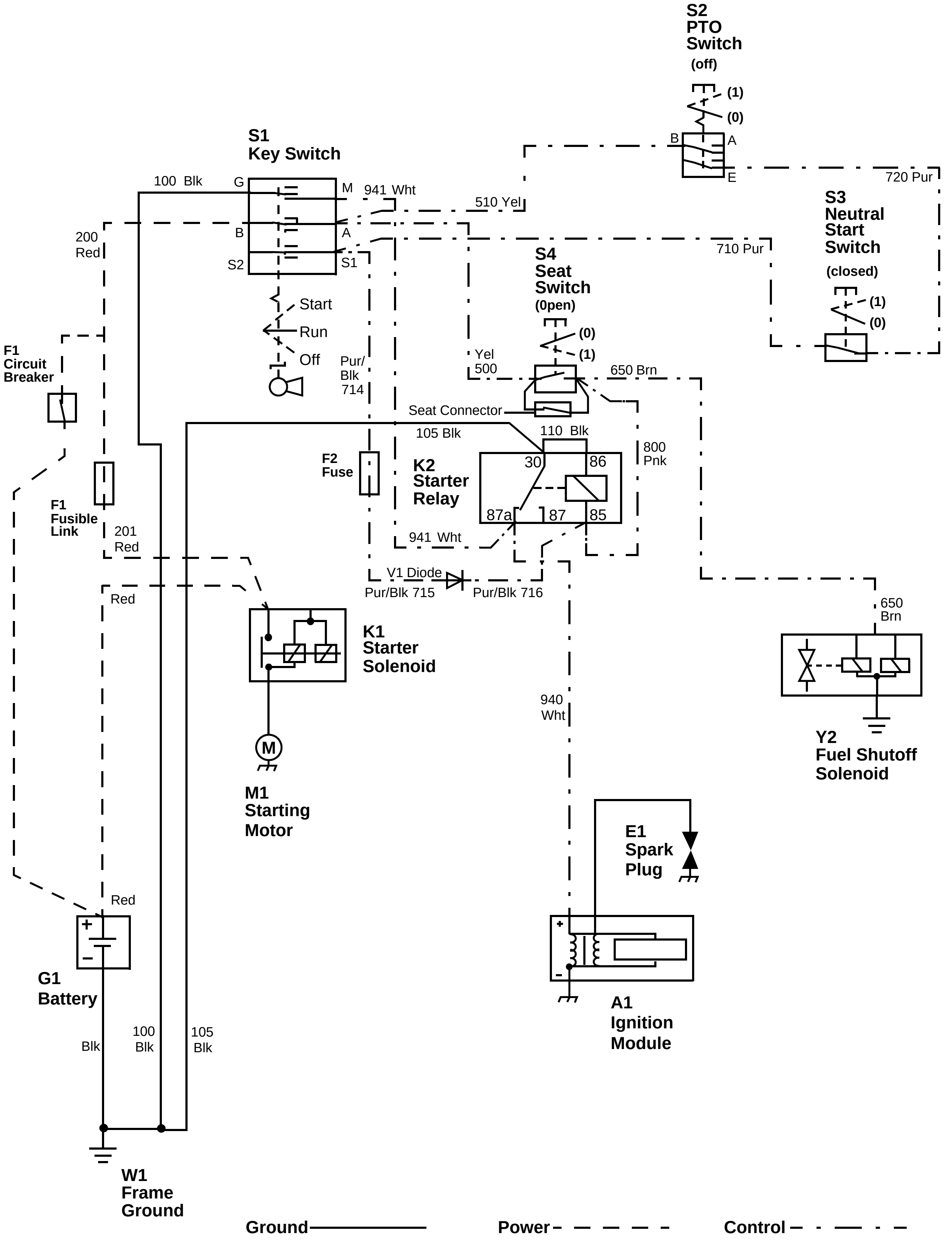
The ignition system is a electronic magneto design. Ignition timing is controlled by the ignition module (A1) and is not adjustable. The engine is shut off by grounding the ignition module through the key switch (S1) (terminals M and G) and the start relay (K1) (terminals 87A and 30). The ignition module is grounded (spark stopped) if the operator gets off the seat with the PTO engaged or the transaxle in gear.

With the key switch (S1) in the start or run position, the key switch eliminates one path to ground for ignition current. The start relay (K1), when energized by the neutral start circuit or the seat switch circuit, eliminates the second path to ground so a spark can be produced.

Current flows from the battery (G1) positive terminal to the fusible link or circuit breaker (F1), and key switch battery terminal. With the key switch in the run position, current flows to the seat switch (S4), and PTO switch (S2). The PTO switch is used to prevent the engine from starting if the PTO is engaged. With the PTO switch closed (PTO disengaged), current flows to the neutral start switch (S3). The neutral start switch is used to prevent the engine from starting if the transaxle is in gear.

With the neutral start switch closed, current flows to the key switch terminal S1, fuse (F2) and start relay coil terminal 85 and energizes the coil, closing the relay. Closing the relay breaks the path to ground for ignition coil current between terminals 87A and 30. Also battery current from the start relay terminal 85 flows to the fuel shutoff solenoid (Y2), and energizes the solenoid allowing fuel flow. An alternate current path is provided to keep to start relay energized when the4 PTO is engaged, or the transaxle is in gear. With the operator on the seat, the seat switch (S4) is closed and current flows to the start relay coil keeping the relay energized.

As the flywheel turns, a magnet in the flywheel produces current in the primary coil by electromagnetic induction. When the primary current is at the highest level, the ignition module induces high voltage current in the secondary coil. The high voltage current flows through the ignition module wire to the spark plug (E2). The voltage is now high enough to jump the spark plug gap and a spark is produced.



SE2- Ignition Circuit

IGNITION CIRCUIT DIAGNOSIS STX30 & STX38 (SN —210000)

When diagnosing an ignition problem, isolate the magneto circuit from the ground circuit by separating the engine connector. If the engine will not start check the magneto circuit first and them check the ground circuit. If the engine will not shut off, check the ground circuit. Remember the engine is stopped by grounding the ignition coil through either the key switch or the start relay. The start relay must be energized to prevent the ignition coil from being grounded.

Test Conditions:

- Park brake engaged
- Transaxle in neutral
- PTO switch disengaged
- Engine connector disconnected
- Spark plug lead connected to Spark Tester
- Key switch in start position
- Meter negative (-) lead on engine ground
- Meter positive (+) lead on numbered test point

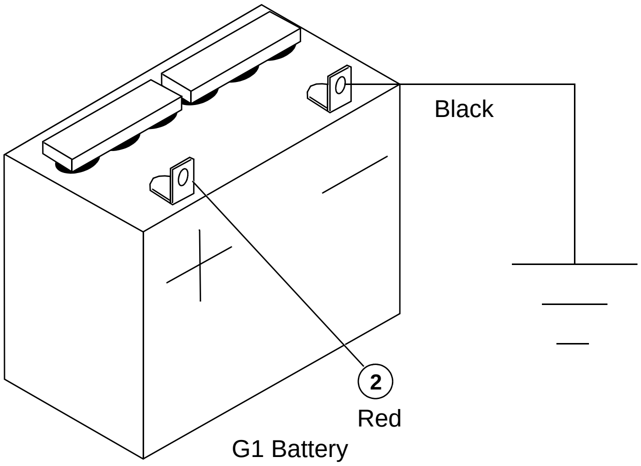
Test/Check Point	Normal	If Not Normal
1. Spark tester	Spark test indicates hot blue spark	No spark—test ignition module, check armature air gap and flywheel magnets. Spark—check spark plug gap and condition or replace spark plug. If plug is good, continue testing ground circuit.

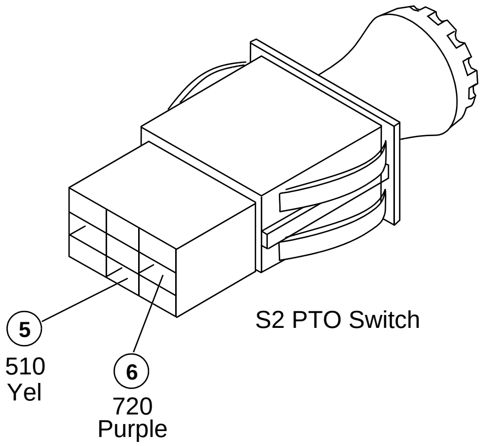
Test Conditions:

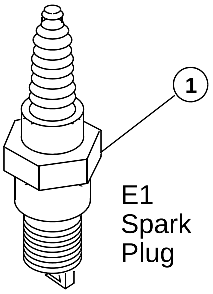
- Engine connector connected
- Key switch in run position

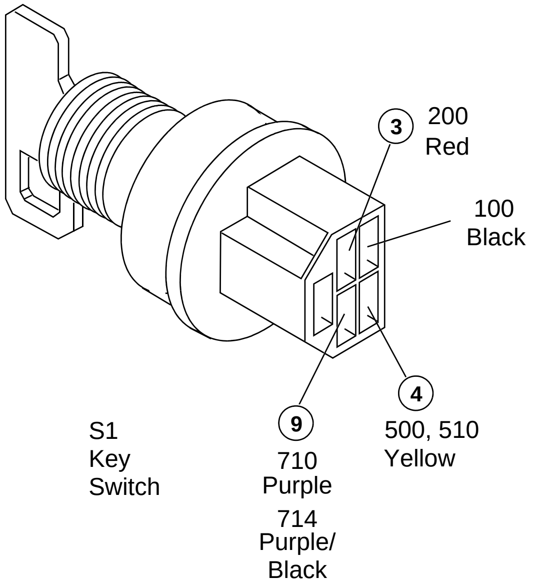
Test/Check Point	Normal	If Not Normal
2. Battery positive terminal.	11.8—13.2 volts	Test battery
3. Key switch terminal B.	Battery voltage	Check battery cable connection, fusible link or circuit breaker, and 200/210 red wires.
4. Key switch terminal A.	Battery voltage	Replace key switch.
5. PTO switch—yellow wire.	Battery voltage	Replace 510 yellow wire.
6. PTO switch—720 purple wire.	Battery voltage	Replace PTO switch.
7. Neutral start switch—720 purple wire.	Battery voltage	Test 720 purple wire.
8. Neutral start switch—710 purple wire.	Battery voltage	Replace neutral start switch.
9. Key switch terminal S1.	Battery voltage	Test 710 purple wire.
10. Fuse—714 pur/blk wire.	Battery voltage	Test 714 pur/blk wire.
11. Fuse—715 pur/blk wire.	Battery voltage	Replace fuse
12. Start relay terminal 85—715 pur/blk wire.	Battery voltage	Test 715 pur/blk wire and diode.

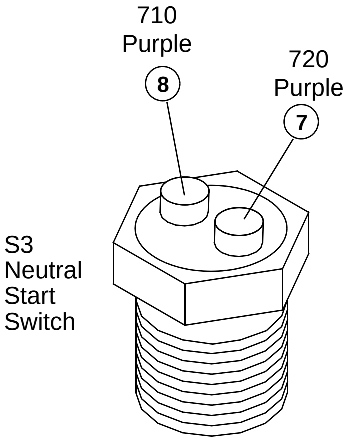
IGNITION CIRCUIT TEST POINTS STX30 & STX38 (SN —210000)



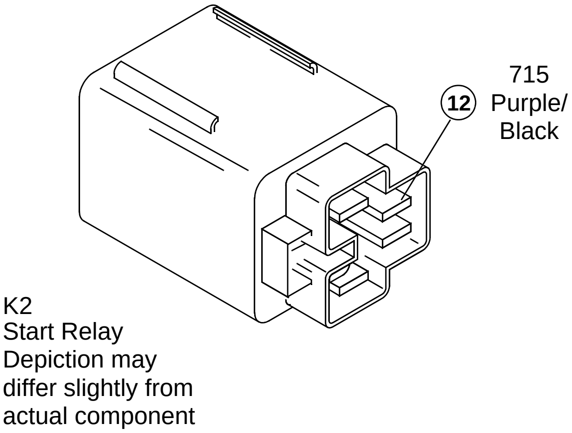


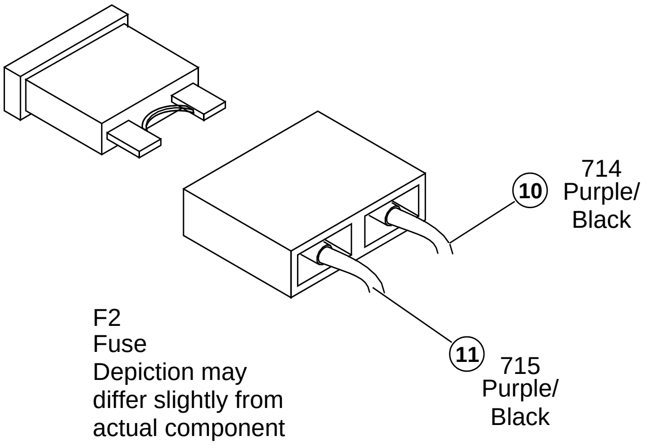






Late Model STX38 & STX46—
S3 switch is labeled brake switch





IGNITION CIRCUIT DIAGNOSIS STX30 & STX38 (SN —210000)

Test Conditions:

- Park brake engaged
- Transaxle in neutral
- PTO switch disengaged
- Key switch in run position
- Seat switch depressed
- Meter negative (-) lead on engine ground
- Meter positive (+) lead on numbered test point

Test/Check Point	Normal	If Not Normal
13. Seat switch—yellow wire.	Battery voltage	Test 500 yel wire.
14. Seat switch—pink wire.	Battery voltage	Replace seat switch.
15. Start relay terminal 85—Remove F2 fuse , check voltage, then install fuse.	Battery voltage	Test pink wire.

Test Conditions:

- Key switch in off position
- Key switch connector disconnected

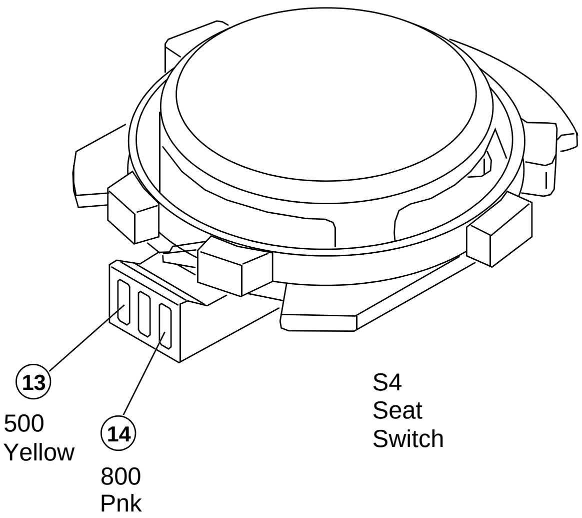
Test/Check Point	Normal	If Not Normal
16. Start relay terminal 30.	Maximum 0.1 ohms	Check battery negative cable, frame ground connection, and 105 blk wire.
17. Start relay terminal 86.	Maximum 0.1 ohms	Check 110 blk wire.
18. Start relay terminal 87A.	Maximum 0.1 ohms	Replace start relay.
19. Key switch connector—wht wire.	Maximum 0.1 ohms	Check 941 wht wire.
20. Engine connector—wht wire.	Maximum 0.1 ohms	Check 940 wht wire.
21. Key switch connector—blk wire.	Maximum 0.1 ohms	Check 100 blk wire.
22. Key switch terminals G and M.	Continuity	Replace key switch.

Test Conditions:

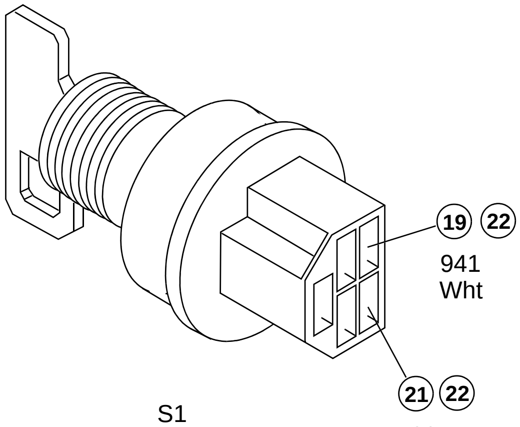
- Key switch connector connected
- Key switch in on position

Test/Check Point	Normal	If Not Normal
23. Start relay terminal 87A.	No continuity to ground.	Replace start relay.

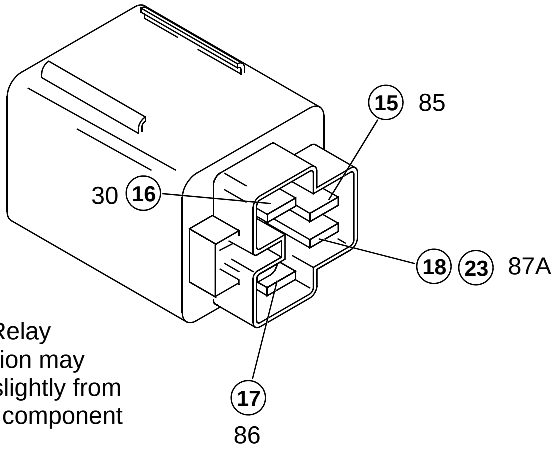
IGNITION CIRCUIT TEST POINTS STX30 & STX38 (SN —210000)



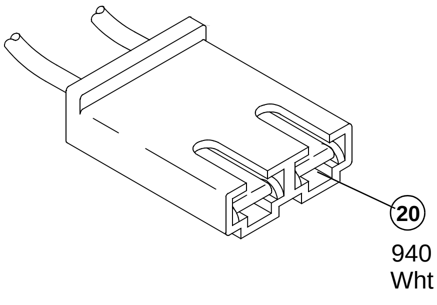
S4
Seat
Switch



S1
Key
Switch



K2
Start Relay
Depiction may
differ slightly from
actual component



X1
Engine
Connector

IGNITION CIRCUIT OPERATION STX38 (SN 210001—) & STX46

Function:

To create a spark that ignites the fuel/air mixture in the engine.

Operating Conditions:

To produce a spark, the key switch (S1) must be in the START or RUN position. The operator can be ON or OFF the seat—seat switch (S4); however, the PTO switch (S2) must be OFF and the brake switch (S3) must be ENGAGED (brake pedal applied) to start the engine. Once the engine is running, the operator must be ON the seat to engage the transaxle (brake pedal must also be released) or operate the PTO.

Theory of Operation:

The ignition system is an electronic magneto design. Ignition timing is controlled by the ignition module (A1) and is NOT ADJUSTABLE.

Battery (G1) current is always present at key switch (S1) terminal “B”. When the optional fuel shut-off solenoid (Y2) is installed, it becomes energized when the key switch (S1) is in either START or RUN position, via terminal “A”, unseating the plunger and allowing fuel flow into the venturi of the carburetor. When the key switch is turned OFF, current flow is broken and internal spring force closes the solenoid plunger, stopping fuel flow.

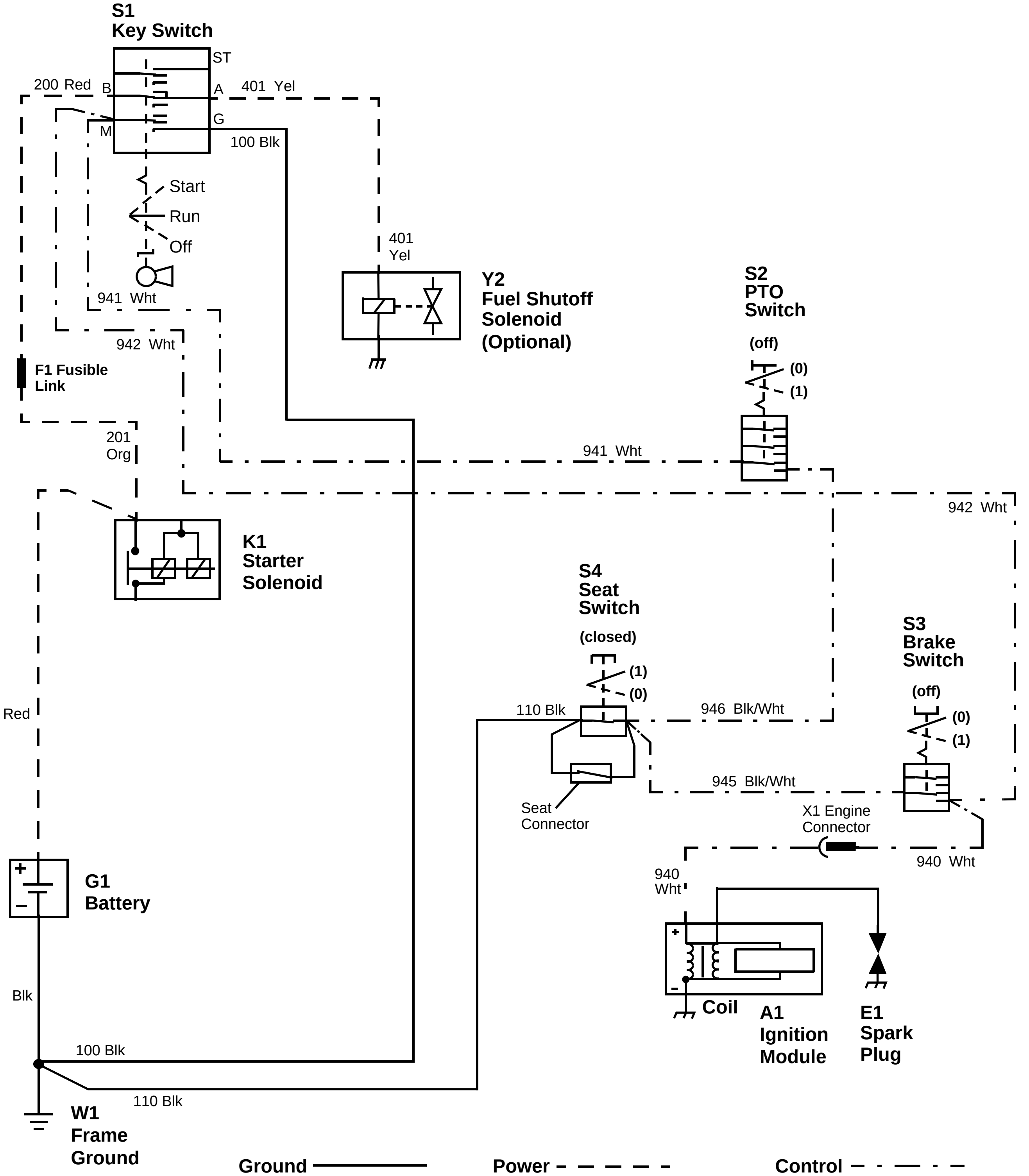
As the flywheel turns in the cranking circuit, a magnet in the flywheel produces current in the primary coil of the ignition module (A1) by electromagnetic induction. When the primary current builds to its highest level, the ignition module (A1) induces high voltage current into the secondary coil. This high voltage current then flows to the spark plug (E1) and jumps the spark plug gap and creates a spark that ignites the fuel/air mixture, causing the engine to start and run.

When the key switch (S1) is in the START or RUN position, the key switch eliminates the path to ground for ignition current, allowing spark generation to continue.

The engine is SHUT-OFF by grounding the ignition module (A1) through: (1) the key switch (S1) or (2) a combination of the brake switch (S3) and seat switch (S4) interaction—if the operator gets OFF the seat with the PTO switch (S2) ENGAGED and the brake switch (S3) NOT ENGAGED (brake pedal released) and/or the transaxle is ENGAGED.

When the brake pedal is RELEASED, the brake switch (S3) plunger closes the two terminals marked “NC” (normally closed) which creates a path to the seat switch (S4) for the ignition module (A1) current. When the operator is OFF the seat, the seat switch (S4) (a normally closed switch) completes the path to ground for the ignition module current, preventing high current induction into the secondary coil which prevents the spark plug (E1) from firing, killing the engine.

The PTO switch (S2) is used to prevent the engine from starting if the PTO switch is ENGAGED. With the PTO switch ON and seat switch (S4) NOT ENGAGED (operator OFF the seat) a path to ground from the ignition module (A1) is created, preventing spark generation to ignite the fuel/air mixture to run the engine.



SE4 - Ignition

IGNITION CIRCUIT DIAGNOSIS STX38 (SN 210001—) & STX46

When diagnosing an ignition problem, isolate magneto circuit from ground circuit by separating engine connector. If engine will not start check magneto circuit first and then check ground circuit. If engine will not shut off, check ground circuit. Remember engine is stopped by grounding ignition coil through either key switch, seat switch or the brake switch and PTO switch

Test Conditions:

- Transaxle/hydro in neutral
- Brake engaged
- Key switch in start position
- PTO switch disengaged
- Engine connector disconnected
- Spark plug lead connected to D05351ST Tester

Test/Check Point	Normal	If Not Normal
1. Spark plug	Spark test indicates hot blue spark.	Test ignition module. Check armature air gap, and flywheel magnets.

Test Conditions:

- Key switch in run position
- Meter positive (+) lead on numbered test point
- Meter negative (—) lead on engine ground

Test/Check Point	Normal	If Not Normal
2. Engine connector 940 white wire.	Infinite resistance	Check for shorted 940/941/ 942 white wires. Check for faulty key switch. Check for faulty PTO switch. Check for faulty or misadjusted brake switch.

Test Conditions:

- Brake disengaged
- Seat switch depressed

Test/Check Point	Normal	If Not Normal
3. Engine connector 940 white wire.	Infinite resistance	Check for shorted 945/946 white/ black wires. Check for faulty seat switch.

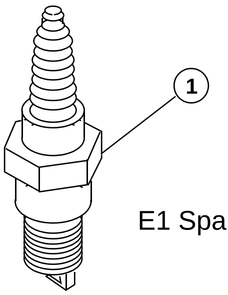
Test Conditions:

- Key switch in off position
- Seat switch released

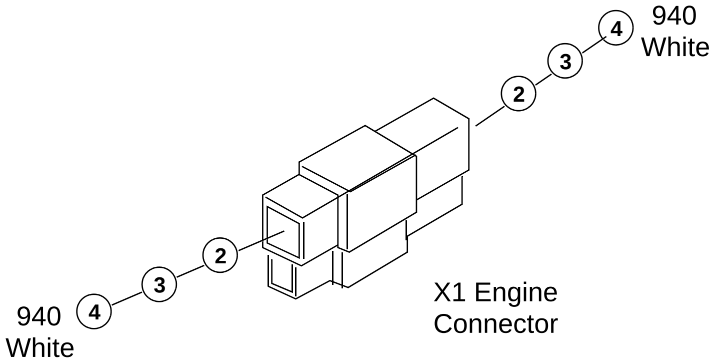
Brake switch released

Test/Check Point	Normal	If Not Normal
4. Engine connector 940 white wire .	Maximum 0.1 ohms	Check for open 940/941/942 white wires. Check for open 100/110 black wires

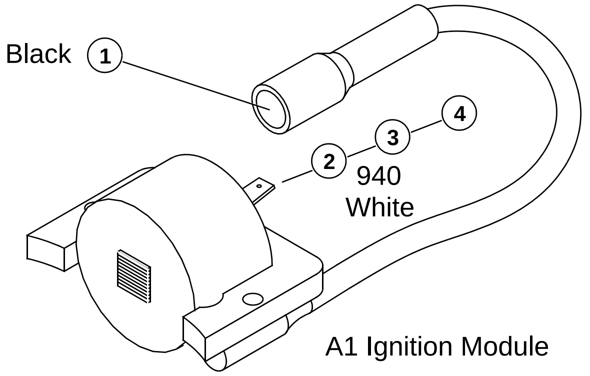
IGNITION CIRCUIT TEST POINTS STX38 (SN 210001—) & STX46



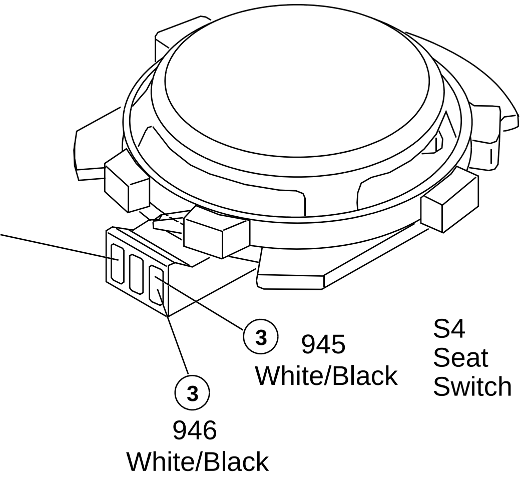
E1 Spark Plug



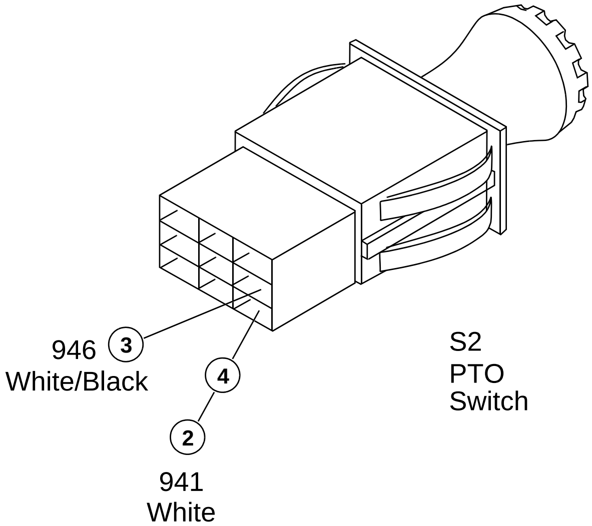
X1 Engine Connector



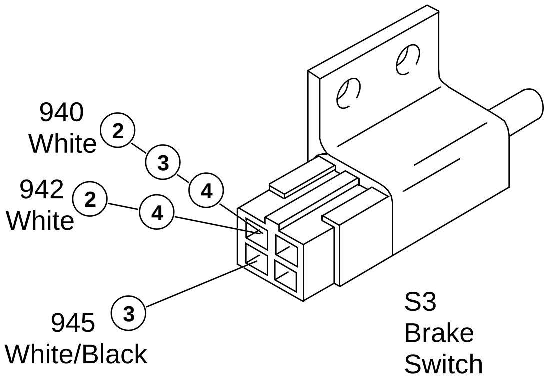
A1 Ignition Module



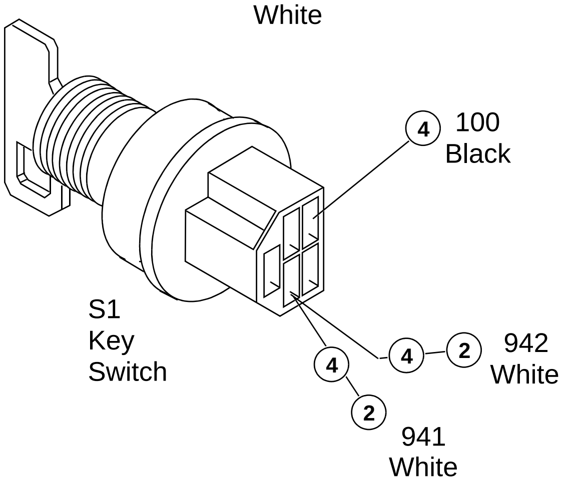
S4 Seat Switch



S2 PTO Switch



S3 Brake Switch



S1 Key Switch

CHARGING CIRCUIT OPERATION STX30 & STX38 (SN —210000)

Function:

To maintain battery voltage between 11.8 and 13.2.

Operating Conditions:

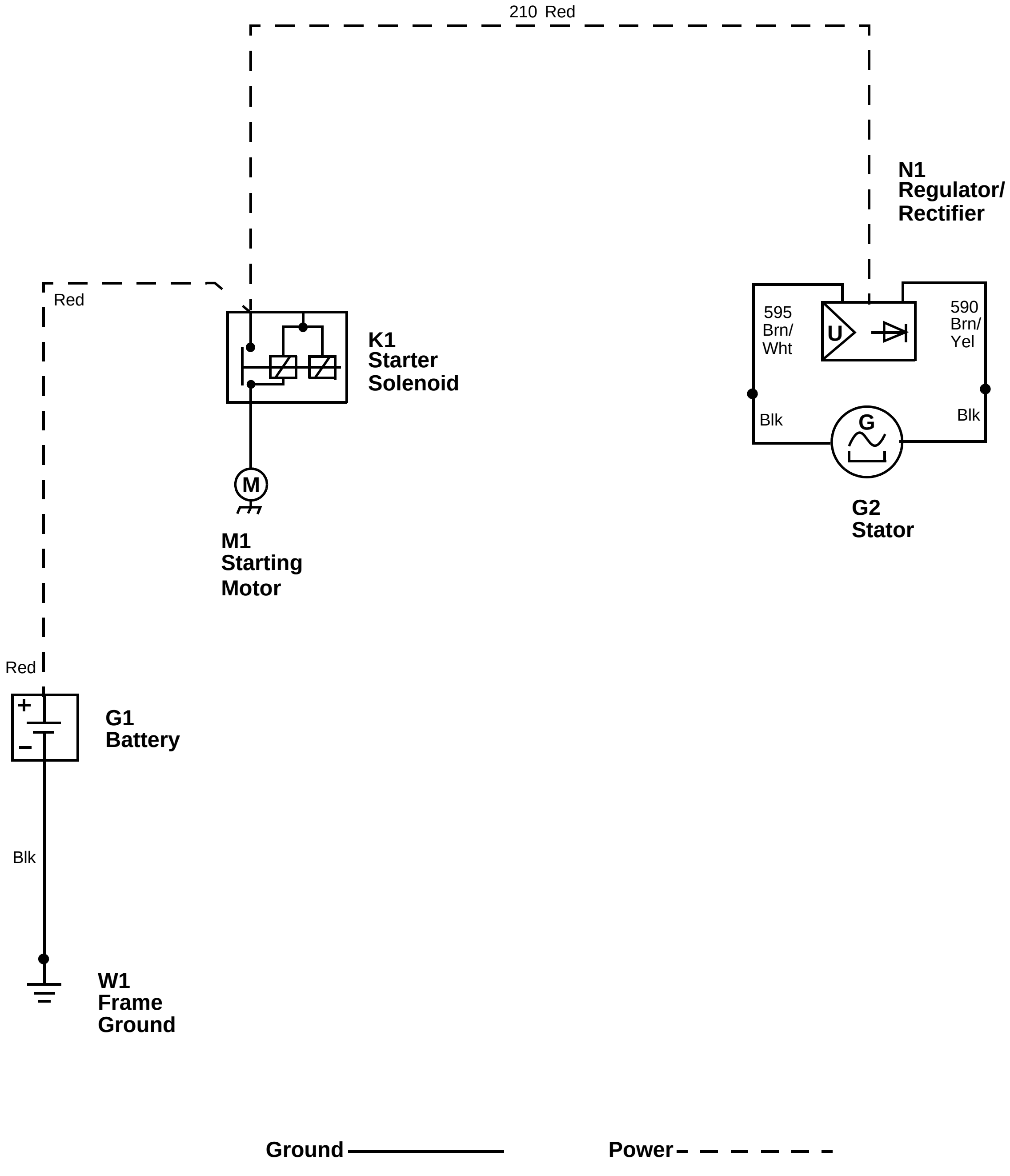
The key switch must be in the run position with the engine running for the charging system to operate.

Theory of Operation:

The charging system is a permanent magnet and stator design. Charging output is controlled by a regulator-rectifier (N1).

As the flywheel turns, a permanent magnet located in the flywheel induces AC current in the stator (G2) windings. The AC current flows to the regulator-rectifier (N1). The regulator-rectifier (N1) converts AC current to DC current needed to charge the battery.

The voltage sensing circuit (210 red wire) allows the regulator-rectifier (N1) to monitor battery voltage. If battery voltage is low, the regulator-rectifier (N1) allows DC current to flow to the regulator to charge it. When the battery is fully charged, the regulator stops current flow to the battery.



SE3 - Charging Circuit

CHARGING CIRCUIT DIAGNOSIS STX30 & STX38 (SN —210000)

Test Conditions:

- Park brake engaged
- Transaxle in neutral
- Regulator/rectifier connector disconnected
- Key switch in run position
- Engine running at fast idle
- Meter negative (-) lead on battery negative (-)
- Meter positive (+) lead on numbered test point

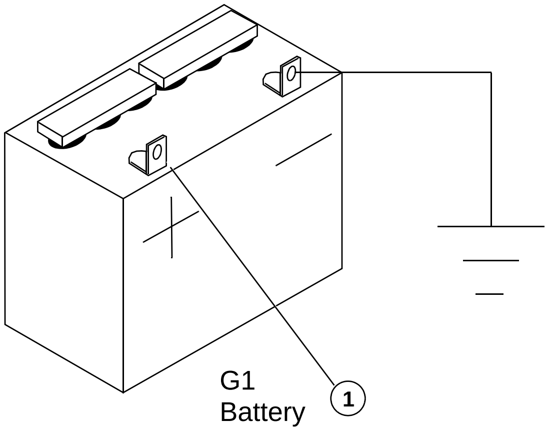
Test/Check Point	Normal	If Not Normal
1. Battery positive terminal.	11.8—13.2 volts	Test battery
2. Regulator/rectifier connector.	Minimum unregulated voltage output—28 VAC.	Check flywheel magnets, if OK replace stator.

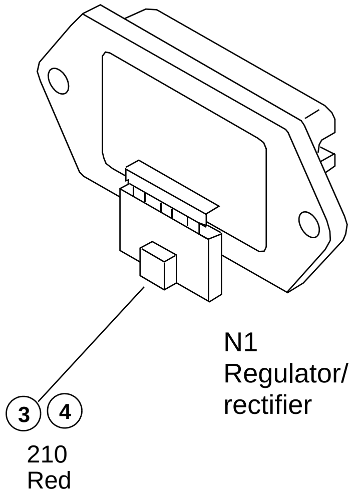
Test Conditions:

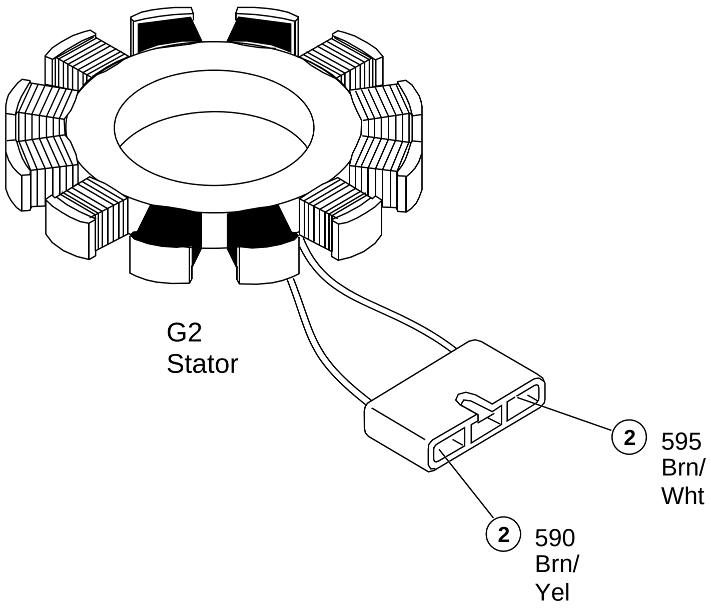
- Regulator/rectifier connector connected

Test/Check Point	Normal	If Not Normal
3. Regulator/rectifier center terminal.	Battery voltage	Check battery positive cable connections, and 210 red wires.
4. Regulator/rectifier wire.	Minimum regulated output— 13 amps at 12.2—14.7 volts Voltage must stay below 14.7 volts.	Replace regulator/rectifier.

CHARGING CIRCUIT TEST POINTS STX30 & STX38 (SN —210000)







CHARGING CIRCUIT OPERATION
STX38 (SN 210001—) & STX46

Function:

To maintain battery voltage between 11.8 and 13.2.

Operating Conditions:

The engine must be running for the charging system to operate.

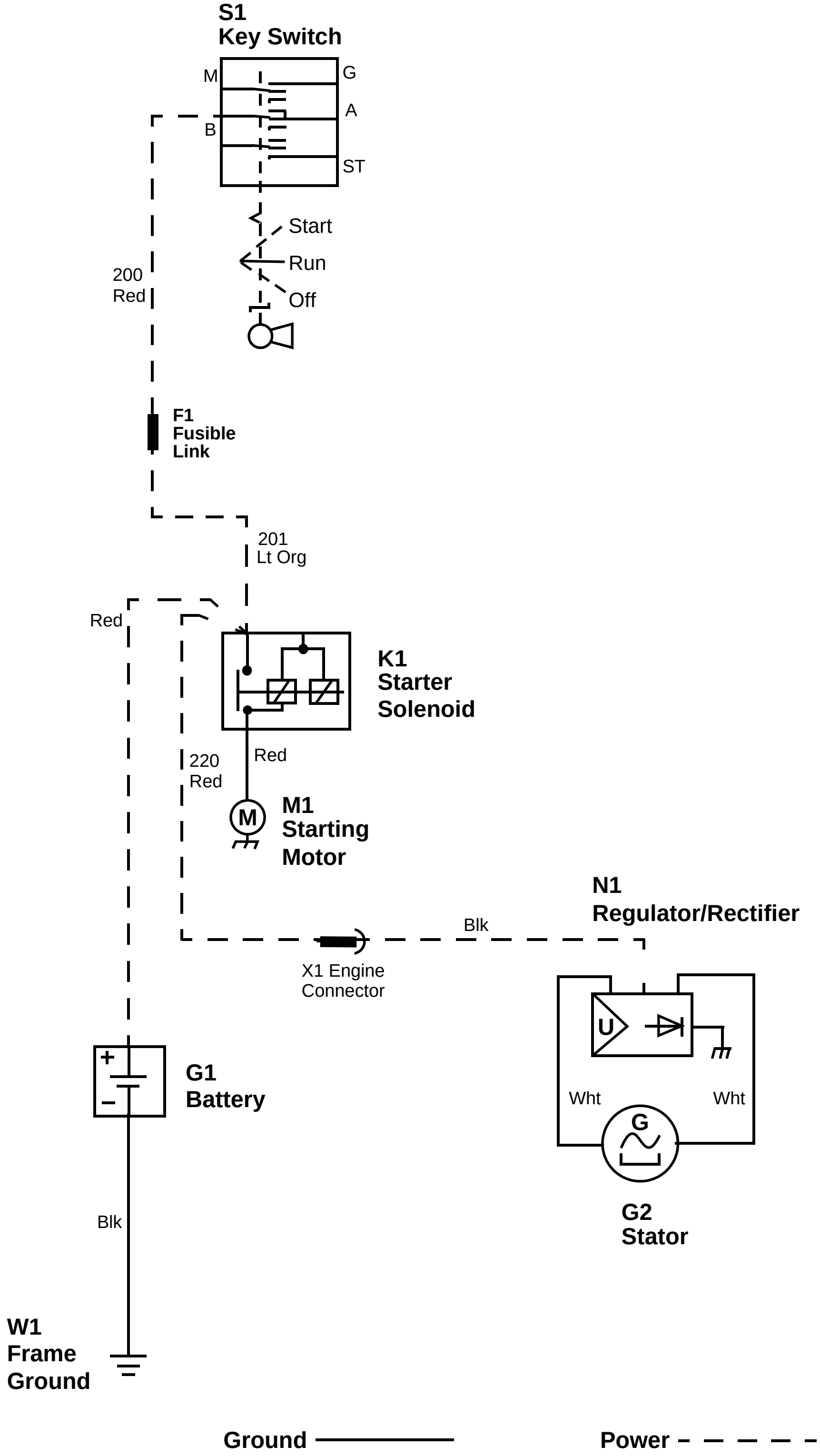
Theory of Operation:

The charging system is of the permanent magnet and stator design. Charging output is controlled by regulator-rectifier (N1).

The key switch (S1) must be in the RUN position and the engine running for the charging circuit to be fully operational.

As the flywheel turns, several permanent magnets (located on the inside lip of the flywheel) induce AC current in the stator (G2) windings. The AC current flows through two white wires to the regulator-rectifier (N1). The regulator-rectifier (N1) converts AC current to DC current needed to charge the battery (G1).

The battery (G1) voltage is sensed by the regulator-rectifier (N1) through the short, black wire of the regulator-rectifier, the positive battery cable (red), and the red wire (220) between the starter solenoid (K1) and engine connector. This allows the regulator-rectifier to monitor battery voltage; if battery voltage is low, rectified DC current is released to charge the battery. When the battery is fully charged, the regulator stops the flow of the rectified DC current to the battery.



SE2- Charging

CHARGING CIRCUIT DIAGNOSIS STX38 (SN 210001—) & STX46

Test Conditions:

- Brake engaged
- Regulator/rectifier connector disconnected
- Key switch in run position
- Engine running at fast idle
- Meter negative (-) lead on battery negative (-) terminal
- Meter positive (+) lead on numbered test point

Test/Check Point	Normal	If Not Normal
1. Battery positive terminal .	11.8-13.2 volts	Test battery
2. Regulator/rectifier connector (between white wires).	Minimum unregulated voltage output — 28 VAC.	Check flywheel magnets, if OK replace stator.

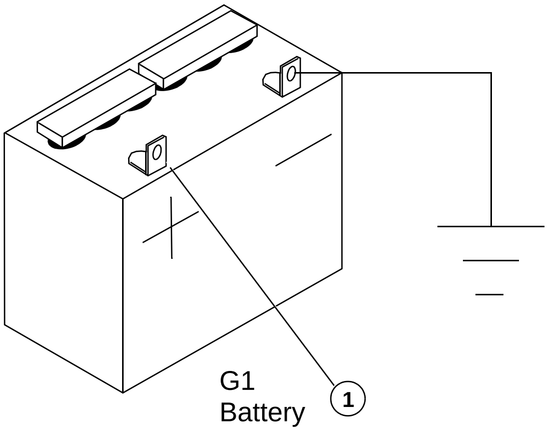
Test Conditions:

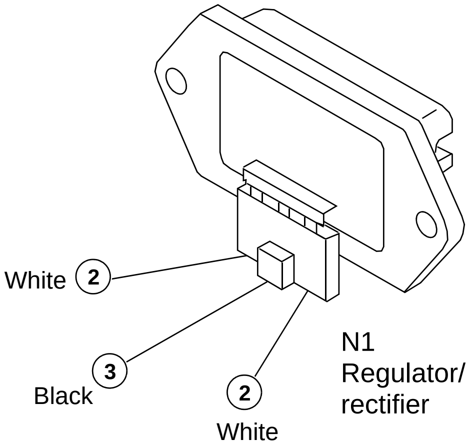
- Regulator/rectifier connector connected

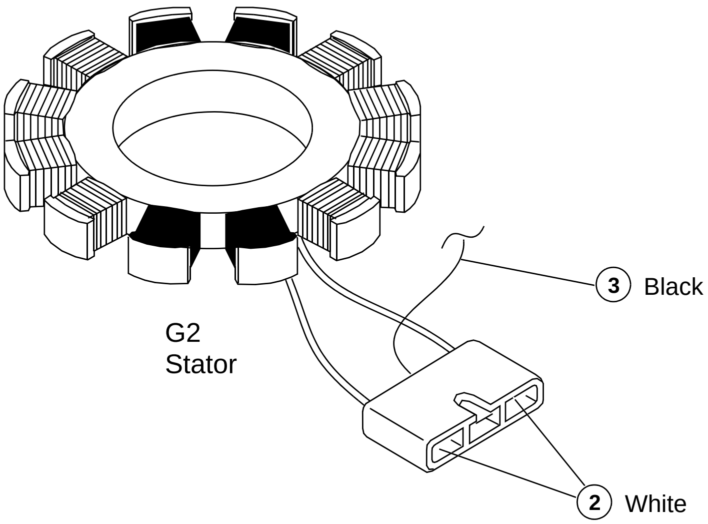
Test/Check Point	Normal	If Not Normal
3. Regulator/rectifier center terminal (black wire).	Battery voltage	Check battery positive cable connections, and 220 red wire.
4. Regulator/rectifier black wire.	Minimum regulated output— 13 amps at 12.2—14.7 volts. Voltage must stay below 14.7 volts.	Replace regulator/rectifier . Replace regulator/rectifier.

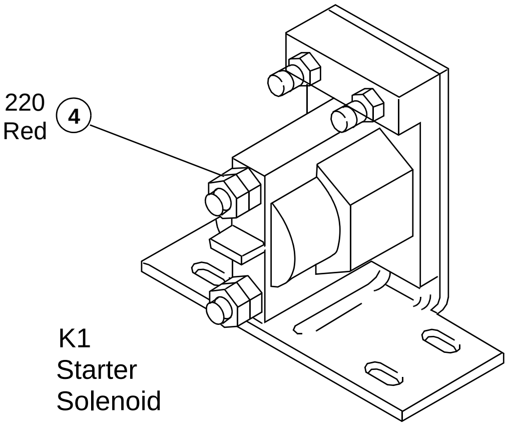
CIRCUIT OPERATION AND DIAGNOSIS

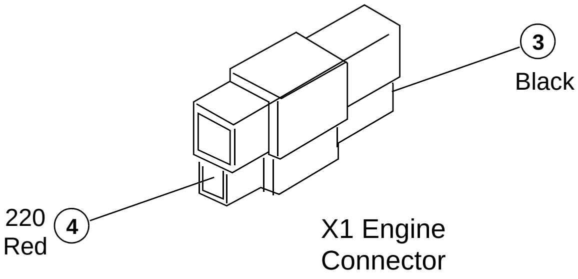
CHARGING CIRCUIT TEST POINTS STX38 (SN 210001—) & STX46











PTO CIRCUIT OPERATION STX30 & STX38 (SN —210000)

Function:

To provide power to energize the PTO clutch.

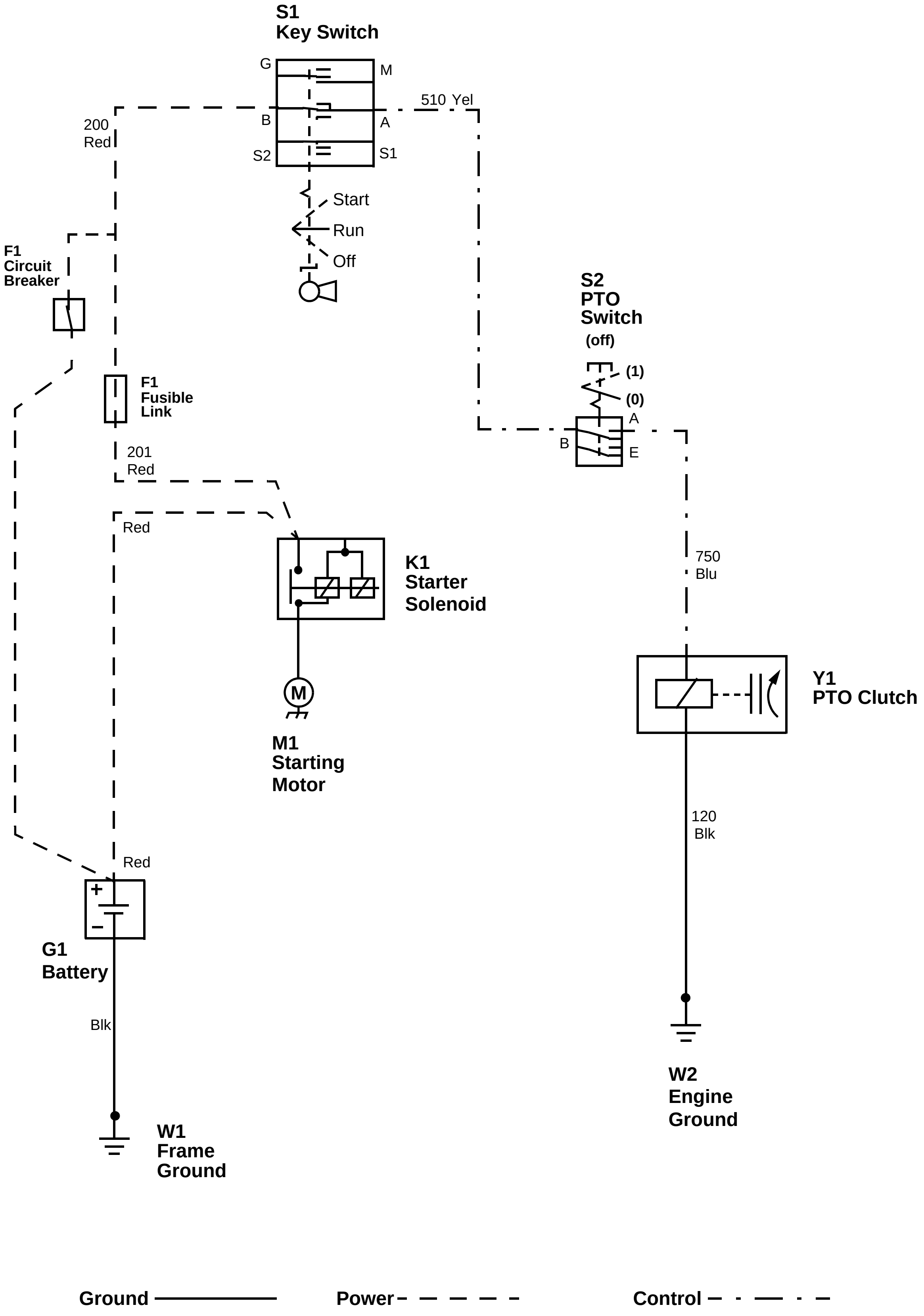
Operating Conditions:

The key switch must be in the run position and the PTO switch must be ON.

Theory of Operation:

The PTO circuit uses the ignition circuit to stop the engine if the operator gets off the seat with the PTO engaged.

Current flows from the battery (G1) positive terminal to the fusible link or circuit breaker (F1) and key switch (S1) battery terminal. With the key switch in the RUN position, current flows to the PTO switch (S2). When the PTO switch is moved to the ON position, current flows through the PTO switch terminals B and A and energizes the PTO clutch (Y1).



SE4 - PTO Circuit

PTO CIRCUIT DIAGNOSIS POINTS STX30 & STX38 (SN —210000)

Test Conditions:

- Transaxle in neutral
- Park brake engaged
- PTO switch ON (engaged)
- Key switch in run position
- Meter negative (-) lead on battery negative (-) terminal
- Meter positive (+) lead on numbered test point

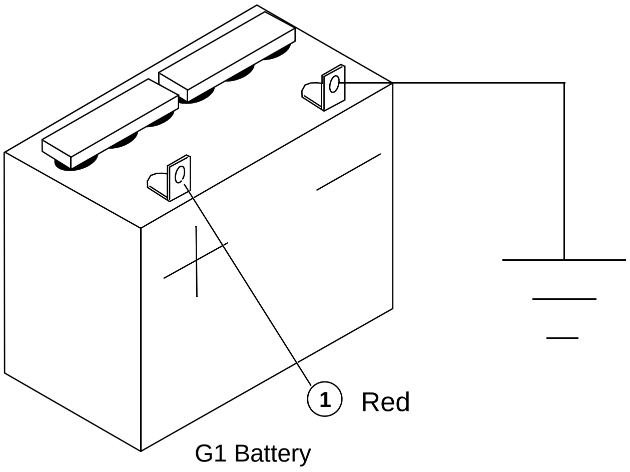
Test/Check Point	Normal	If Not Normal
1. Battery positive terminal.	11.8—13.2 volts	Test battery
2. Key switch terminal B.	Battery voltage	Check battery cable connection, fusible link or circuit breaker and 200/210 red wires.
3. Key switch terminal A.	Battery voltage	Replace key switch.
4. PTO switch—yel wire.	Battery voltage	Test 510 yellow wire.
5. PTO switch—blue wire.	Battery voltage	Replace PTO switch.
6. PTO clutch—yel wire.	Battery voltage	Test 750 blue wire.

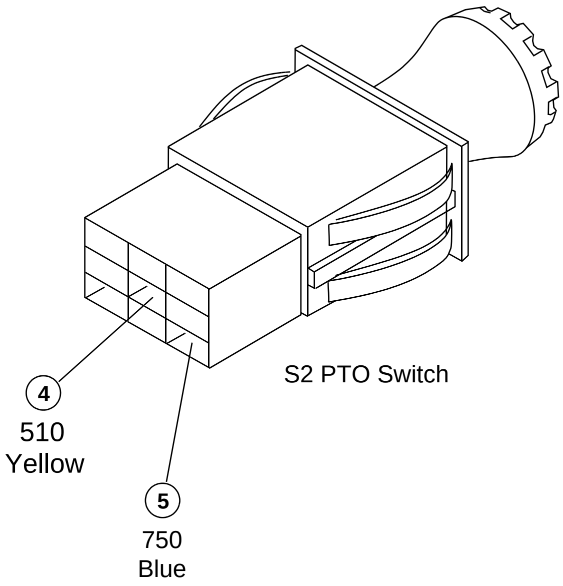
Test Conditions:

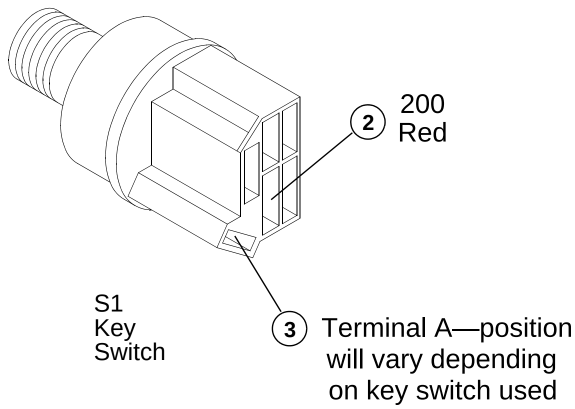
- Key switch in off position

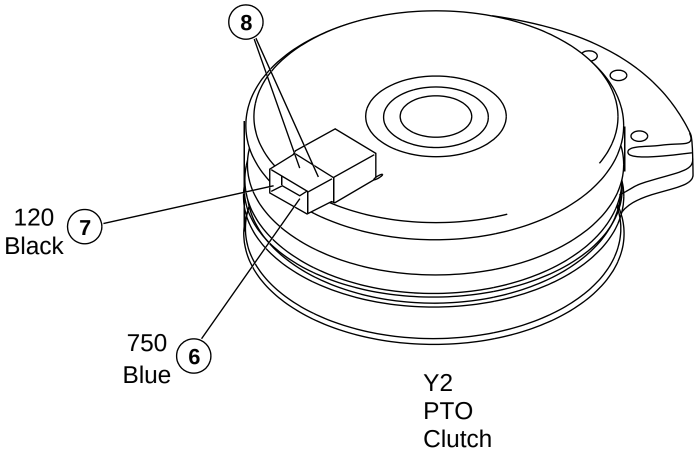
Test/Check Point	Normal	If Not Normal
7. PTO clutch—blk wire.	Maximum 0.1 ohms	Check PTO clutch ground circuit—120 blk wire, engine, frame, and battery negative cable ground connection.
8. PTO clutch	PTO clutch air gap Warner—0.38—0.64 mm (0.015—0.025 in.) Ogura—0.30—0.51 mm (0.012—0.020 in.)	Adjust air gap to 0.51 mm (0.020 in.) . If air gap OK, replace PTO clutch.

PTO CIRCUIT TEST POINTS STX30 & STX38 (SN —210000)









PTO AND HEADLIGHTS CIRCUITS OPERATION
STX38 (SN 210001—) & STX46

Function:

To provide power to energize the PTO clutch and headlights (optional).

Operating Conditions:

PTO—

The key switch (S1) must be in the RUN position, the seat switch must be DEPRESSED (operator ON the seat), the brake switch must be turned OFF (brake pedal released), and the PTO switch (S2) must be ENGAGED.

Headlights—

The key switch (S1) must be in RUN position and the optional headlight switch (S5) must be pushed ON (ENGAGED).

Theory of Operation:

PTO—

The PTO circuit uses the ignition circuit to stop the engine if the operator gets off the seat with the PTO engaged.

Current flows from the battery (G1) positive terminal to the key switch (S1) via the starter solenoid (K1) connection point, fusible link (F1) 201 light orange wire, and 200 red wire. With the key switch (S1) in the RUN position, current flows to the PTO switch (S2) via the 400 yellow wire.

The seat switch must be ENGAGED (operator ON the seat) to prevent a path to ground for the ignition circuit through the turned OFF (released) brake switch, allowing the engine to RUN and power the PTO drive sheave.

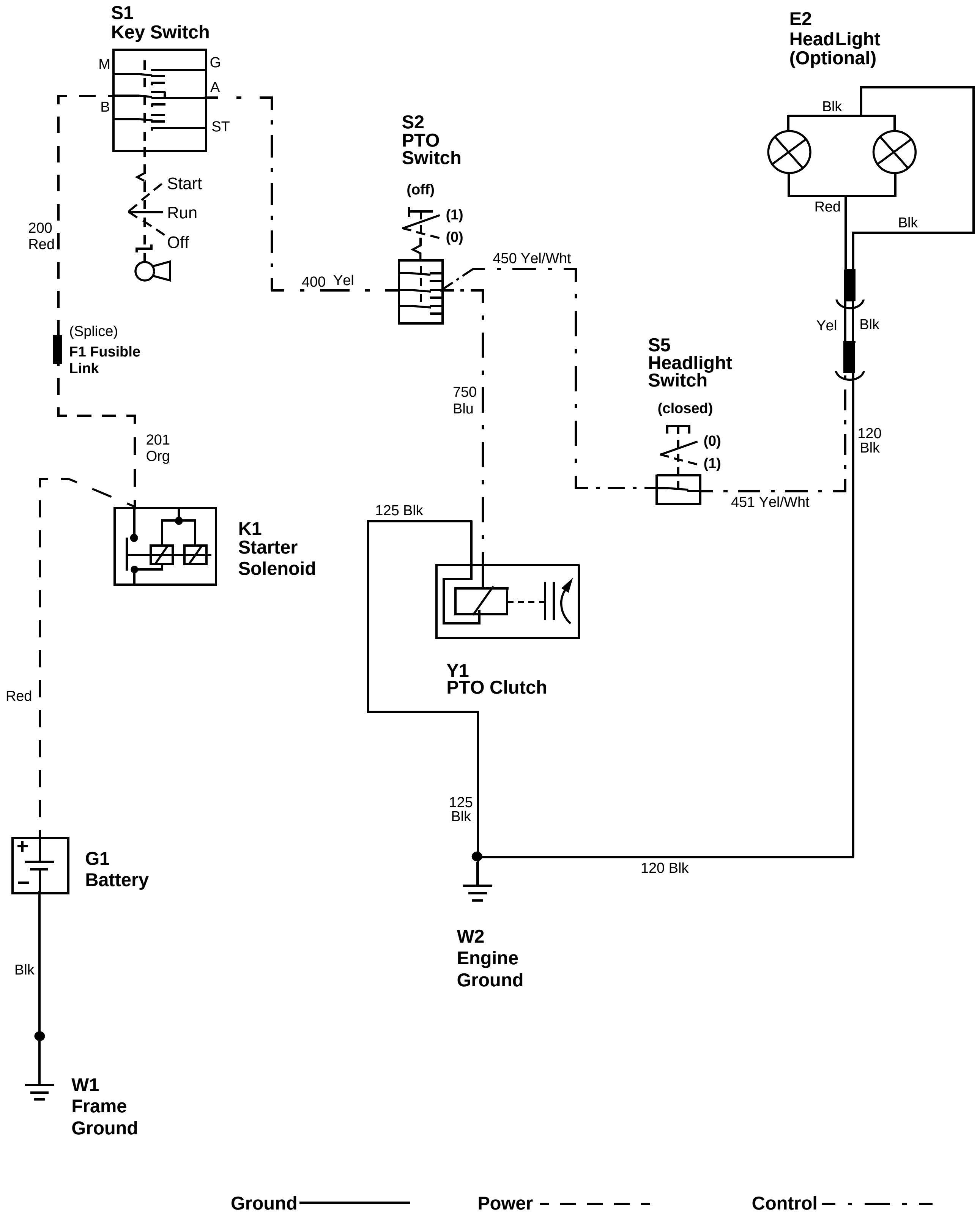
When the PTO switch (S2) is moved to the ON position (ENGAGED), current flows through the PTO switch (S2) and 750 blue wire to energize the PTO clutch (Y1) windings. The energized PTO clutch magnet pulls the PTO clutch brake away from the sheave plate, allowing the sheave plate to turn with the engine crankshaft.

If the operator gets OFF the seat, the seat switch creates a path to ground for the ignition circuit and the engine kills. Once the engine has been killed, the PTO switch (S2) must be pushed into the OFF position before the cranking circuit can be engaged to restart the engine.

Headlights—

Current flows from the battery (G1) positive terminal to the key switch (S1) via the starter solenoid (K1) connection point, fusible link (F1) 201 light orange wire, and 200 red wire. With the key switch (S1) in the RUN position, current flows to the PTO switch (S2) via the 400 yellow wire. At this tie point, current flows through the 450 yellow/white to the headlights switch (S5). When the headlights switch (S5) is pushed ON (ENGAGED), current flows through the 451 yellow/white wire through the headlights kit harness yellow wire into the two red wire to the twin headlights, then to engine ground (W2) via the black wires of the headlights kit harness and the tractor harness 120 black wire.

The headlights are turned OFF by turning off the headlights switch (S5) or the key switch (S1).



SE3 - PTO	**SE5 - Headlights**

PTO CIRCUIT DIAGNOSIS STX38 (SN 210001—) & STX46

NOTE: If there excessive vibration in PTO clutch area and noise coming from vibration between PTO clutch and pin—see page 4-53 step 5.

Test Conditions:

- Transaxle/hydro in neutral
- Brake engaged
- PTO switch ON (engaged)
- Key switch in run position
- Meter negative (-) lead on battery negative (-) terminal
- Meter positive (+) lead on numbered test point

NOTE: Fusible link (F1) 201 orange wire is designed to melt internally. You cannot see that the fusible link is bad by looking at it, test for battery voltage at 200 red wire at key switch terminal B to verify fusible link is good.

Test/Check Point	Normal	If Not Normal
1. Battery positive terminal	11.8—13.2 volts	Test battery
2. Key switch terminal B (200 red wire).	Battery voltage	Check battery cable (red) connection, fusible link 201 orange and 200 red wire.
3. Key switch terminal A (400 yellow wire).	Battery voltage	Replace key switch (S1).
4. PTO switch 400 yellow wire.	Battery voltage	Test 400 yellow wire.
5. PTO switch 750 blue wire.	Battery voltage	Replace PTO switch.
6. PTO clutch 750 blue wire.	Battery voltage	Test 750 blue wire.

Test Conditions:

- Key switch in OFF position

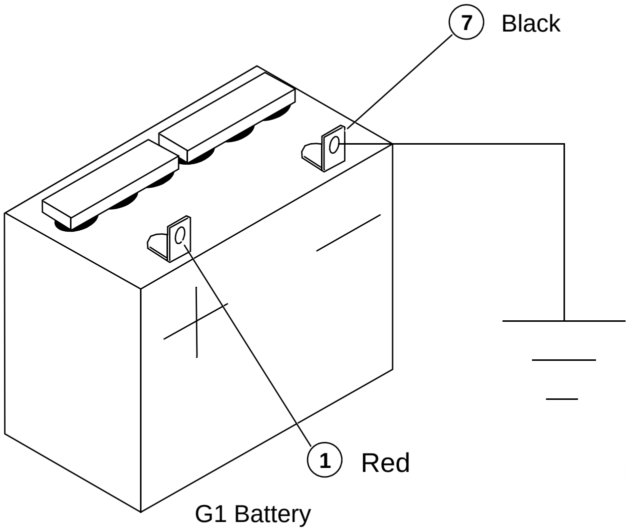
Test/Check Point	Normal	If Not Normal
7. PTO clutch125 black wire.	Maximum 0.1 ohms	Check PTO clutch 125 black wire engine ground circuit, and battery negative cable ground connection.

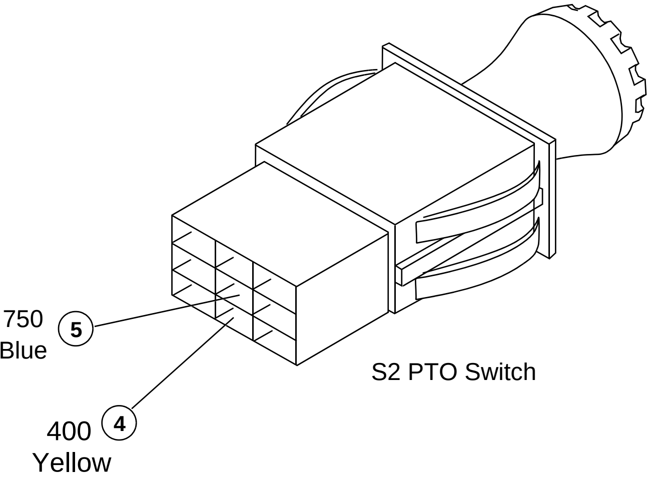
Test Conditions:

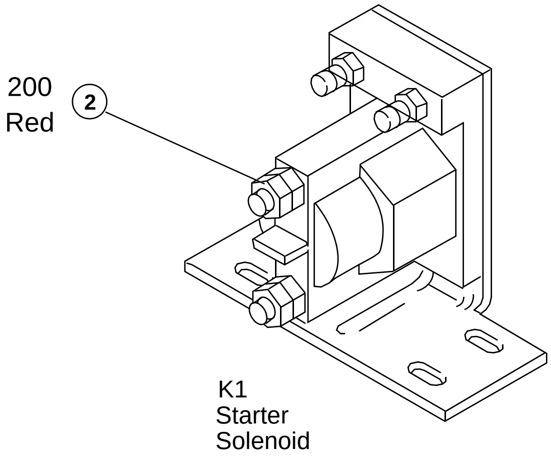
- Key switch in OFF position
- Disconnect PTO clutch harness connector

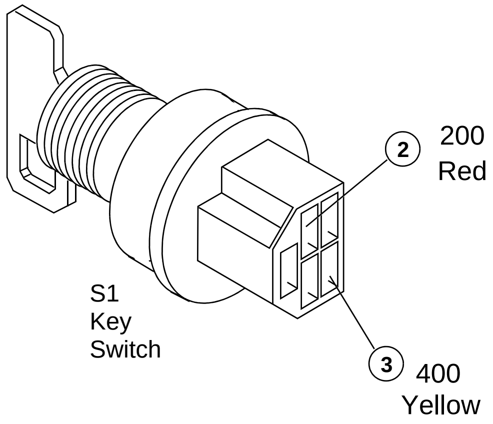
Test/Check Point	Normal	If Not Normal
8. Across PTO clutch terminals.	Resistance of coil between 3 and 10 ohm.	If less than 3 or greater than 10 ohm resistance, replace PTO clutch.

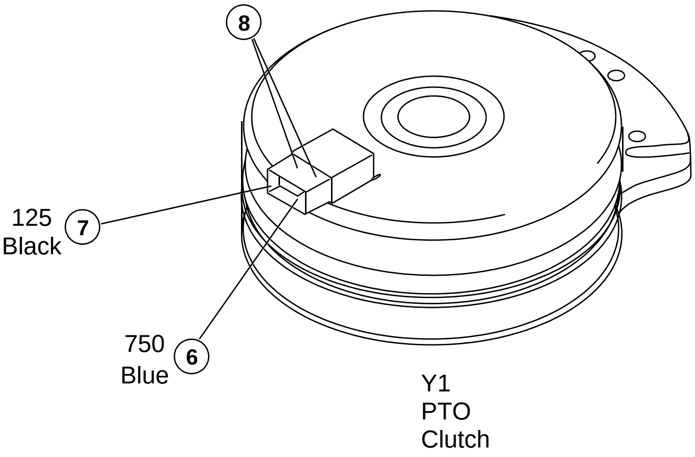
PTO CIRCUIT TEST POINTS STX38 (SN 210001—) & STX46











HEADLIGHTS CIRCUIT DIAGNOSIS STX38 (SN 210001—) & STX46

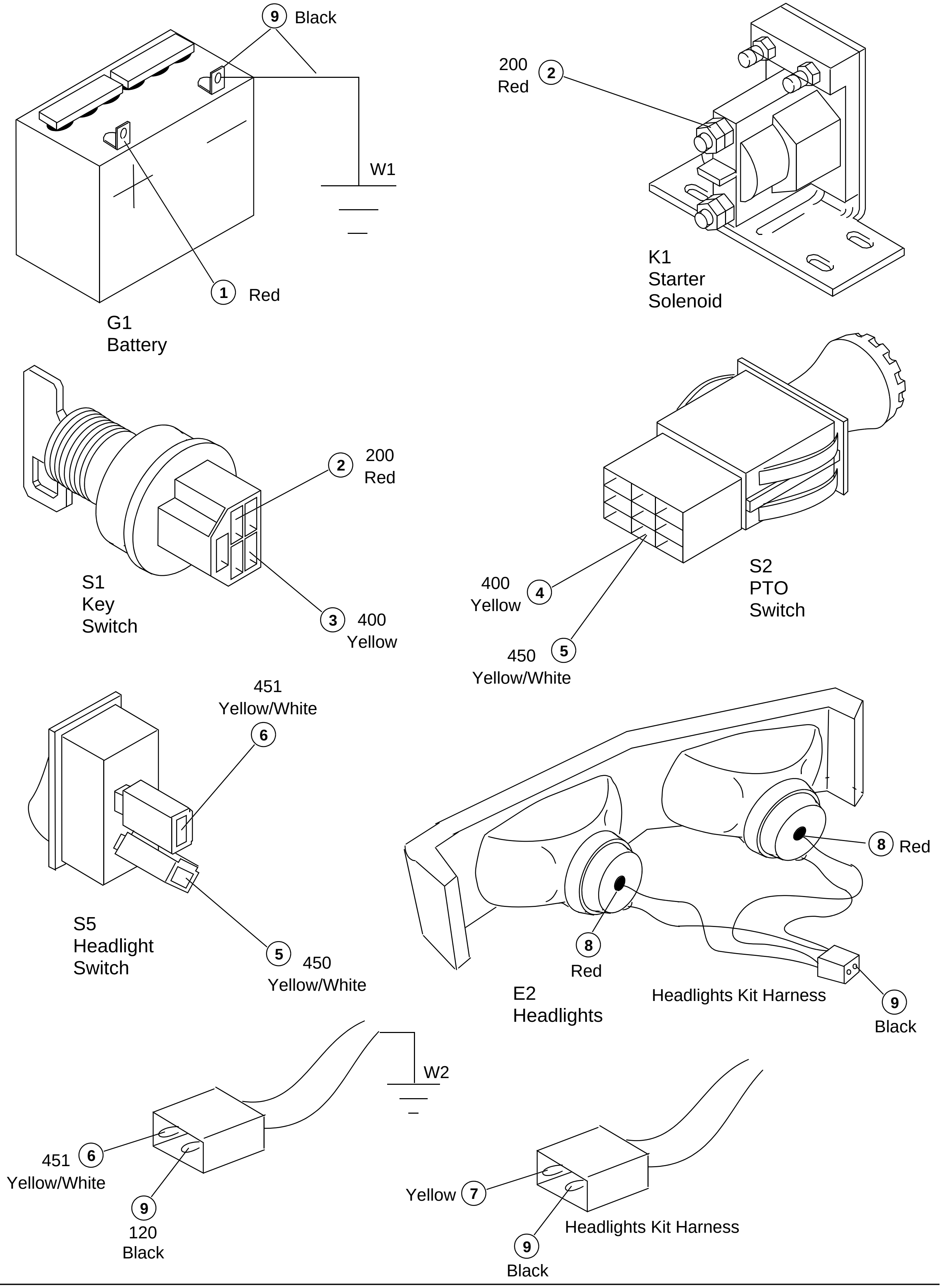
Test Conditions:

- Key switch in RUN position
- Meter negative (-) lead on battery negative (-) terminal
- Headlights switch ON (engaged)
- Meter positive (+) lead on numbered test point

NOTE: Fusible link (F1) 201 orange wire is designed to melt internally. You cannot see that the fusible link is bad by looking at it, test for battery voltage at 200 red wire at key switch terminal B to verify fusible link is good.

Test/Check Point	Normal	If Not Normal
1. Battery positive terminal	11.8—13.2 volts	Test battery
2. Key switch terminal B (200 red wire).	Battery voltage	Check battery cable connection, fusible link 201 orange and 200 red wire.
3. Key switch terminal A (400 yellow wire).	Battery voltage	Replace key switch.
4. PTO switch 400 yellow wire.	Battery voltage	Test 400 yellow wire.
5. Headlights switch 450 yellow/white wire.	Battery voltage	Replace 450 yellow/white wire.
6. Headlights switch 451 yellow/white wire.	Battery voltage	Replace headlights switch.
7. Headlights kit harness yellow wire.	Battery voltage	Replace 451 yellow/white wire.
8. Headlights kit light sockets red wires.	Battery voltage	Replace headlights kit light sockets and harness.
9. Headlights kit harness black wires and tractor harness 120 black wire at W2 engine ground.	Battery voltage	If ground circuit is good, replace bulbs.

HEADLIGHTS CIRCUIT TEST POINTS STX38 (SN 210001—) & STX46



TESTS AND ADJUSTMENTS

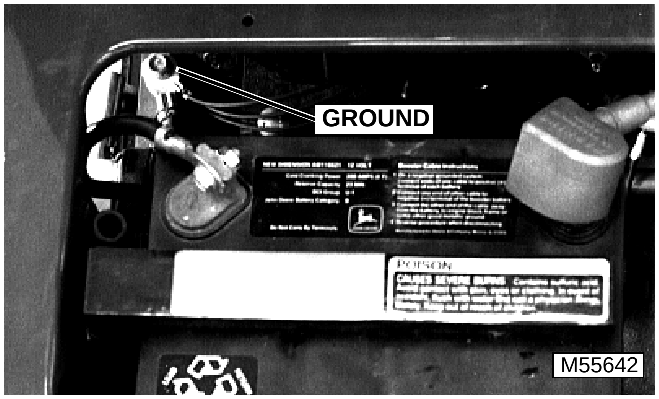
GROUND CIRCUIT TESTS

Reason:

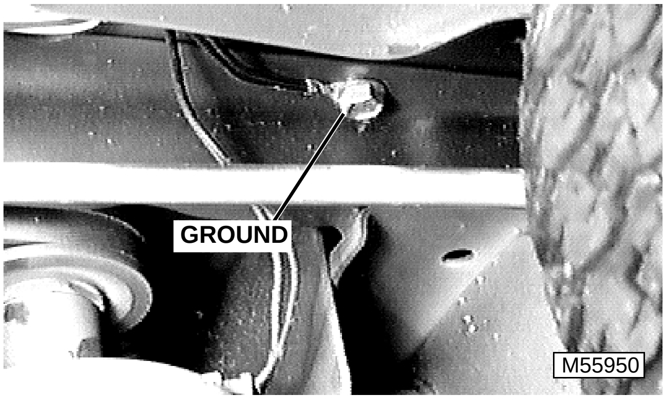
To check for opens, loose terminal wire crimps, poor connections, or corrosion in the ground circuit. The voltmeter method checks ground connections under load.

Equipment:

- Ohmmeter or voltmeter



W1—Frame Ground



W2—Engine Ground

Procedure:

OHMMETER METHOD:

1. Turn key switch to off position. Engage park brake.
2. Connect ohmmeter negative (black) lead to negative terminal of battery. Put meter positive (red) lead on negative terminal of battery and record reading.
3. Put meter red lead on ground terminal of circuit or component to be tested that is closest to the battery negative terminal. Resistance reading must be very close to or the same as the battery negative terminal reading. Work backwards from the battery on the ground side of the problem circuit until the resistance reading increases above 0.1 ohms. The problem is between the last two test points. If a problem is indicated, disconnect the wiring harness connector to isolate the wire or component and check resistance again. Maximum allowable resistance in the circuit is 0.1 ohms. Check both sides of connectors closely as disconnecting and connecting may temporarily solve problem.

VOLTMETER METHOD:

1. Put transmission in neutral. Engage park brake. Put PTO switch in off position. Turn key switch to on position.
2. Connect voltmeter negative (black) lead to negative terminal of battery.
3. Put meter positive (red) lead on ground terminal of component to be tested. Be sure the component circuit is activated (key on, switches closed) so voltage will be present at the component. Record voltage. Voltage must be greater than 0 but less than 1 volt. Some components will have a very small voltage reading on the ground side and still be operating correctly.

Results:

- If resistance is above 0.1 ohms, check for open wiring, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.
- If voltage is 0, the component is open.
- If voltage is greater than 1 volt, the ground circuit is bad. Check for open wiring, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.

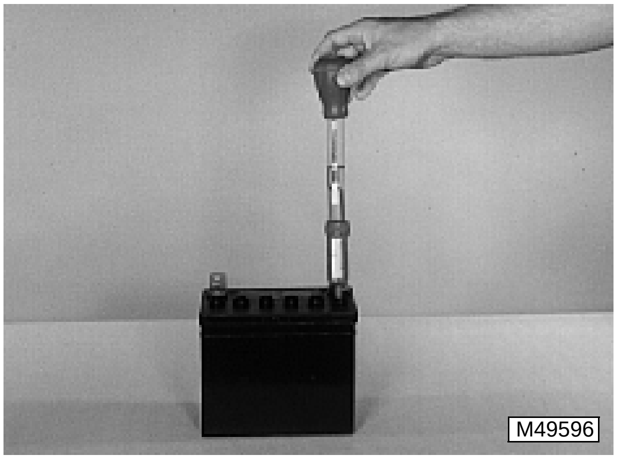
BATTERY TEST

Reason:

To check condition of battery and determine battery voltage.

Equipment:

- Hydrometer
- Voltmeter or JTO5685 Battery Tester


M49596

Procedure:

1. Clean battery terminals and top of battery.
2. Inspect battery terminals and case for breakage or cracks.
3. Check electrolyte level in each battery cell. Add clean, soft water as needed. If water was added, charge battery for 20 minutes at 10 amps.
4. Remove surface charge by placing a small load on the battery for 15 seconds.
5. Check specific gravity of each cell with a hydrometer.
6. Check battery voltage with voltmeter or JTO5685 Battery Tester.

Specifications:

Minimum specific gravity
. . . . 1.225 with less than 50 point variation
Minimum battery voltage. . . . . 12.4 volts

Results:

- Battery voltage less than 12.4 VDC, charge battery.
- Battery voltage more than 12.4 VDC, test specific gravity.
- All cells less than 1.175, charge battery at 10 amp rate.
- All cells less than 1.225 with less than 50 point variation, charge battery at 10 amp rate.
- All cells more than 1.225 with less than 50 point variation, load test battery.
- More than 50 point variation: replace battery.

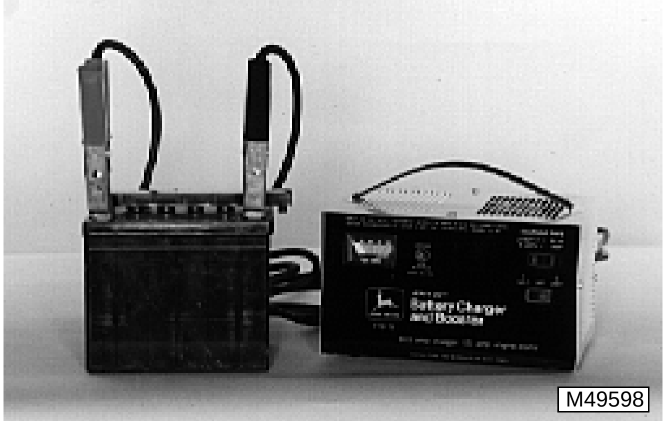
CHARGE BATTERY

Reason:

To increase battery charge after battery has been discharged.

Equipment:

- Battery charger (variable rate)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Procedure:

NOTE: See BATTERY TEST in this group before charging battery.

1. Connect variable rate charger to battery.

NOTE: Maximum charge time at boost setting is 10 minutes. Allow additional 5 minutes for each 10 degrees below 70 degrees F.

2. Start charger at slow rate. Increase charge rate one setting at a time. Check charger ammeter after 1 minute at each setting. Maintain 10 amp charge rate. Use boost setting as necessary.

Continued on next page

3. Check if battery is accepting a 10 amp charge after 10 minutes at boost setting.

   Battery will not accept 10 amp charge after 10 minutes at boost setting: replace battery.

   Battery is accepting 10 amp charge after 10 minutes at boost setting, and battery did not need water: go to steps 6 and 7.

   Battery is accepting 10 amp charge after 10 minutes at boost setting, but battery did need water or all cells were below 1.175: go to steps 4 and 5.
4. Set charger at 15—25 amps.

IMPORTANT: Decrease charge rate if battery gases or bubbles excessively or becomes too warm to touch.

5. Check specific gravity after 30 minutes (60 minutes for maintenance-free battery).

   More than 50 point variation between cells: replace battery.

   Less than 50 point variation between cells: go to steps 6 and 7.

NOTE: *If battery was discharged at slow or unknown rate, charge at 10—15 amps for 6—12 hours. (Maintenance-free battery: 12—24 hours.) If battery was discharged at fast rate, charge at 20—25 amps for 2—4 hours. (Maintenance-free battery: 4—8 hours.)*

6. Continue charging battery until specific gravity is 1.230—1.265 points.
7. Load test battery.

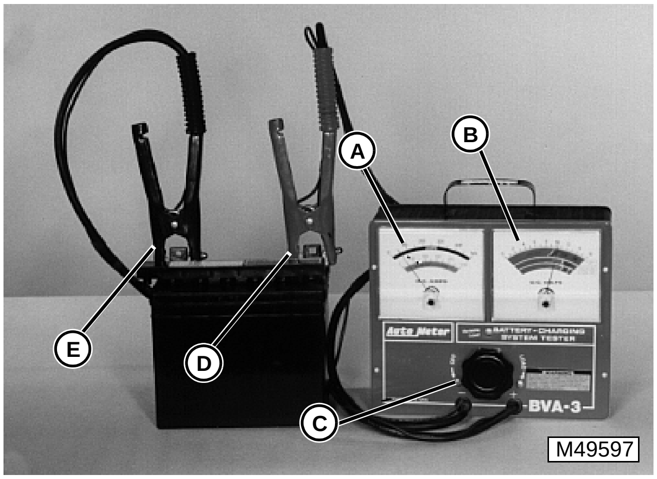
BATTERY LOAD TEST

Reason:

To check condition of battery under load.

Equipment:

- JTO5685 Battery Tester



Connections:

1. Turn load knob (C) of tester counter-clockwise to off.
2. Connect tester positive cable (D) to battery positive terminal.
3. Connect tester negative cable (E) to battery negative terminal.

Procedure:

1. Turn load knob of tester clockwise until amperage reading (A) is equal to:
   - Cold cranking amperage rating (use blue scale).

     — OR —
   - Three times ampere hour rating (use black scale).
2. Hold for 15 seconds and turn load knob of tester off.
3. Repeat procedure steps 1 and 2 from above and read condition of battery at DC Volts scale (B).

Results:

- If the battery does not pass the test and has not been charged, charge battery and retest.
- If the battery does not pass the test and has been charged, replace the battery.

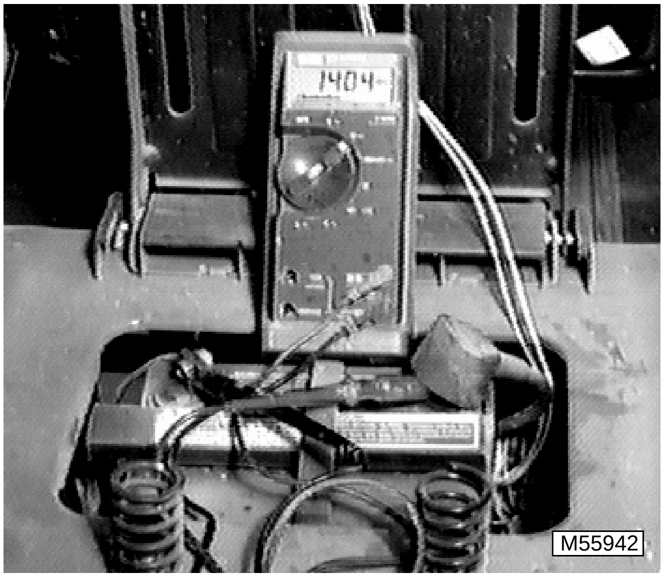
REGULATED VOLTAGE OUTPUT TEST

Reason:

To determine regulated voltage output of the regulator/rectifier.

Equipment:

- Voltmeter



Connections:

1. Remove surface charge from battery by cranking engine for 15 seconds.
2. Connect meter red lead to positive battery terminal.
3. Connect meter black lead to negative battery terminal.

Procedure:

1. Start and run engine at HIGH IDLE.
2. Read meter several times during 5 minutes of running time.

Specifications:

Regulated voltage . . . . 12.2—14.7 VDC at high idle

Results:

- If the DC voltage stays below the minimum specification or does not increase, test Unregulated Voltage Output in this group.
- If the DC voltage goes above the maximum specification, replace the regulator.

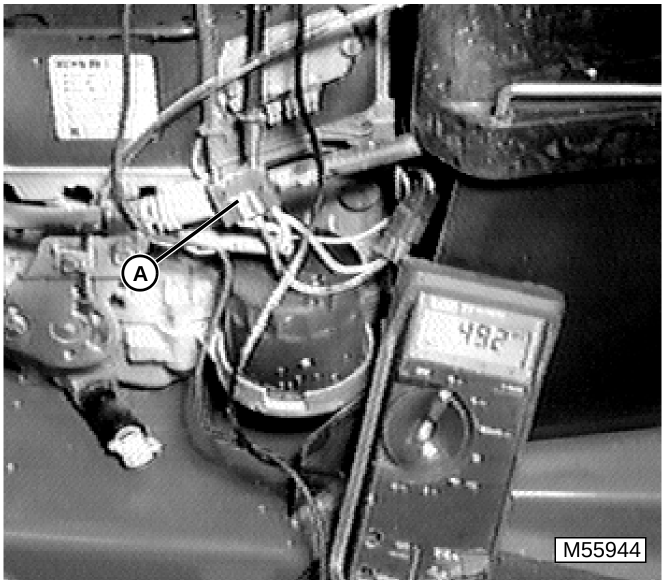
UNREGULATED VOLTAGE OUTPUT TEST

Reason:

To measure stator voltage output to determine stator condition.

Equipment:

- Voltmeter



Connections:

1. Disconnect regulator/rectifier connector (A).
2. Set voltmeter to AC voltage.
3. Connect meter across outside terminals.

Procedure:

1. Start and run engine to specifications.
2. Measure stator voltage.

Specifications:

Export—

Engine speed. . . . . .3000 rpm

Minimum stator voltage . . . . 24 VAC

Domestic—

Engine speed. . . . . .3350 rpm

Minimum stator voltage . . . . 28 VAC

Results:

- If reading is less than specifications, test FLYWHEEL MAGNET and then replace the stator.
- If stator voltage is OK, check charging circuit wires, then replace regulator/rectifier.

STARTER SOLENOID TEST

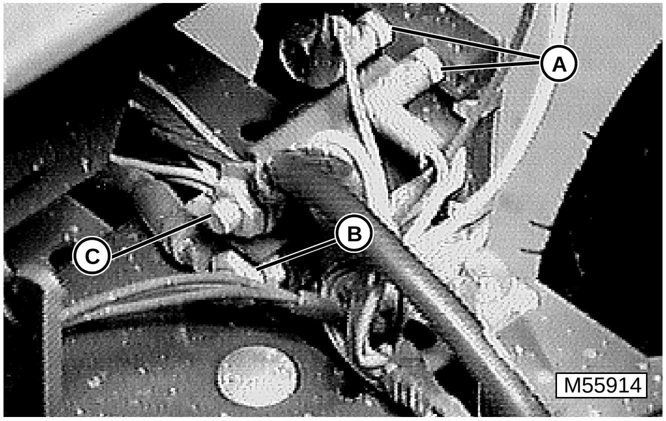
Reason:

To determine if starter solenoid or starter is defective.

IMPORTANT: STX38 Serial Numbers (STXH270001—277450) (STXJ270001—275010) (STXH270001—)—If the starter pinion fails to disengage from flywheel the steel and nylon washers in the bendix of the starter are reversed. Correct order is spring, steel washer, nylon washer, spring retainer, retainer ring, and dust cap.

Equipment:

- Jumper wire



Connections:

1. Put transaxle in neutral. Move key switch to off position.
2. Engage park brake.
3. Disconnect and ground spark plug lead.
4. Disconnect purple wire from small starter solenoid engagement terminals (A).

Procedure:

1. Connect jumper wire to positive battery terminal and briefly jump to bare small starter solenoid engagement terminal (A). All solenoid terminals should be clean and free of corrosion.

Results:

- Starter runs: solenoid is good, check circuit wiring.
- Starter does not run: go to step 2.

2. Connect jumper wire between starter solenoid large terminals (B and C).

Results:

- Starter runs: Replace solenoid.
- Starter does not run: Check battery cables then replace starter.

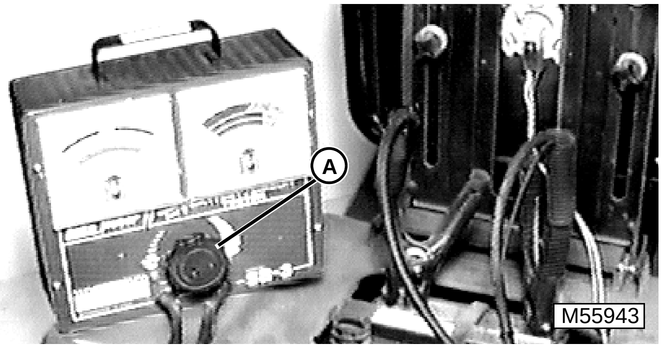
STARTER AMP DRAW TEST

Reason:

To determine the amperage required to crank the engine and check starter motor operation under load.

Equipment:

- JTO5685 Battery Tester
- Photo Tachometer



Connections:

1. Put transaxle in neutral. Engage park brake.
2. Test system ground connections and battery.
3. Turn knob (A) of tester counter-clockwise to off.
4. Connect red clamp of battery tester to positive terminal of battery and black clamp of tester to negative terminal of battery.
5. Install tachometer reflective tape on flywheel screen.
6. Remove spark plug high tension lead and ground to engine.

Procedure:

1. Crank engine and read voltage on DC voltage scale of battery tester and check engine rpm.
2. Turn key switch to off position.

IMPORTANT: Perform the following procedure within 15 seconds to prevent electrical damage to components.

3. Turn knob of battery tester clockwise until the DC voltage is the same as when cranking.
4. Read DC amperage on battery tester.
5. Turn load knob fully counterclockwise.

Specifications:

Maximum starter amp draw
. . . . . .180 amps at 225 rpm

Results:

- If amperage is above specification, or rpm is low, check starter for binding or damaged.
- If starter is good, check internal engine, traction or PTO drive for binding or damage.

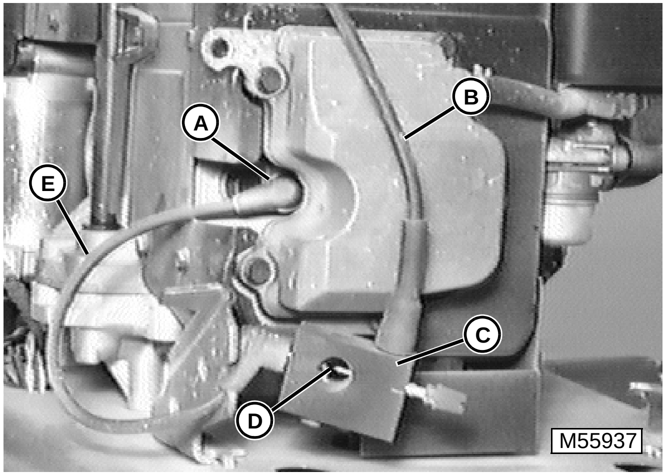
IGNITION SPARK TEST

Reason:

To determine condition of ignition system.

Equipment:

- D-05351ST Spark Tester



Connections:

1. Remove ignition module high tension lead (B) from spark plug (A).
2. Connect spark tester lead (D) to spark plug (A).
3. Connect high tension lead (B) to tester (C).

IMPORTANT: DO NOT adjust spark tester gap (D) beyond 5.0 mm (0.200 in.) as damage to ignition system could occur.

4. Adjust spark tester gag (D) to **4.2 mm (0.166 in.)** with screw (C).

Procedure:

1. Crank or start engine. Watch spark at tester gap.

Results:

- Steady, strong, blue spark - ignition is good. If engine will not start, check fuel supply and engine compression.
- If spark is weak, or no spark, install a new spark plug.
- If spark is still weak or still no spark, see Adjust Ignition Module Air Gap and/or Ignition Module Test..

Specification:

Spark Plug Gap . . . . 1.0 mm (0.040 in.)
Spark Plug Torque . . . . 38—43.4 N•m (28—32 lb-ft.)

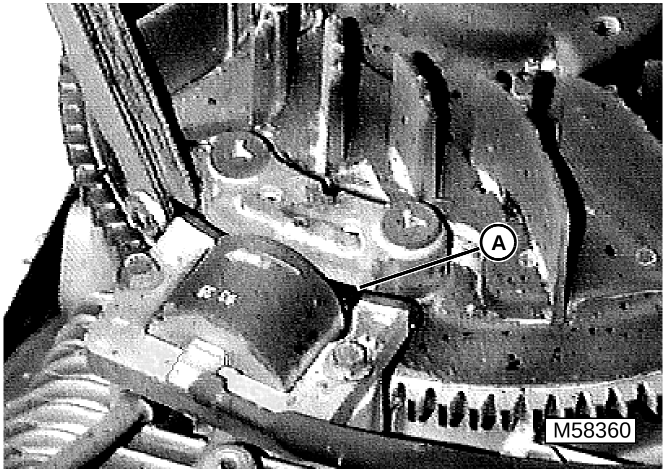
IGNITION MODULE AIR GAP ADJUSTMENT

Reason:

To adjust the air gap between the ignition module and the flywheel to a specific dimension needed for proper ignition timing.

Equipment:

- 0.25 mm (0.010 in.) feeler gauge



Connections:

1. Put transaxle in neutral.
2. Put key switch in OFF position.
3. Remove blower housing.

Procedure:

1. Turn flywheel magnet away from ignition module.
2. Loosen ignition module mounting screws and hold module as far back as possible.
3. Turn flywheel magnet so it is centered on ignition module.
4. Insert **0.25 mm (0.01 in.)** feeler gauge (A) between flywheel magnet and all three ignition module polls. Allow module to draw against feeler gauge (A) and flywheel magnet.
5. Hold module coil in this position and tighten mounting screws to specification.
6. Turn flywheel to remove feeler gauge.
7. Install blower housing.

Specifications:

Ignition module air gap
. . . . . 0.25 mm (0.01 in.)
Ignition Module Cap Screws
. 4.0—6.2 N•m (35—55 lb-in.)

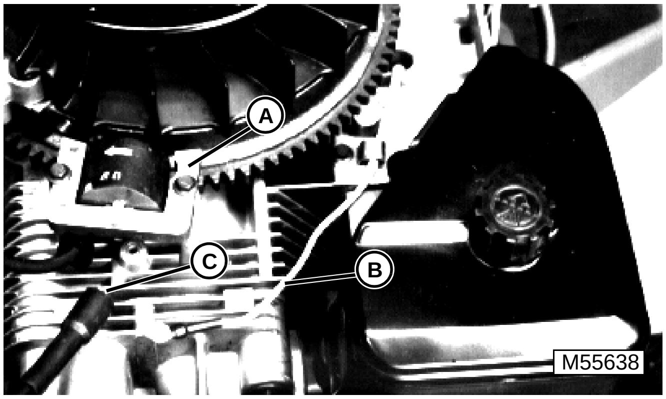
IGNITION MODULE TEST

Reason:

To determine condition of ignition module windings.

Equipment:

- Ohmmeter



Procedure:

1. Put transaxle in neutral. Put key switch in off position.
2. Remove spark plug cap from spark plug wire.
3. Disconnect primary lead wire.
4. Measure resistance between primary lead (B) and core (A). Reverse meter leads and check resistance again.
5. Measure resistance between spark plug lead (C) and core (A).

Specifications:

Primary lead and core resistance:

One direction . . . . 5—1000 ohms

Other direction (Minimum) . . . . 30 K ohms

Spark plug lead and core resistance . . . . .7.9—10.85 K ohms

Results:

- If resistance does not meet specifications, replace the ignition module.

SEAT SWITCH TEST

Reason:

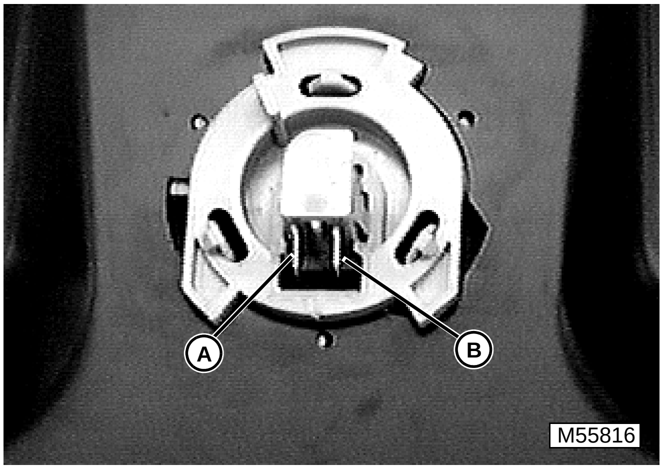
To ensure proper operation of seat switch.

Equipment:

- Ohmmeter

Procedure:

1. Park machine on level surface and turn key switch OFF.
2. Shift lever in NEUTRAL and park brake LOCKED.
3. Disconnect harness connector from seat switch.



4. Check continuity across switch terminals (A) and (B).

Results:

- There should BE continuity between terminals (A and B) when seat is RELEASED,
- There should NOT BE continuity between terminals (A and B) when plunger is DEPRESSED.
- If continuity is NOT correct, replace switch.

NOTE: The seat switch connector has an interlock spring which shorts the 3 wires together when it is removed from the seat switch terminals. Check that spring mechanism is releasing properly when the center tab is depressed.

BRAKE PEDAL/PARK BRAKE SWITCH TESTS

Reason:

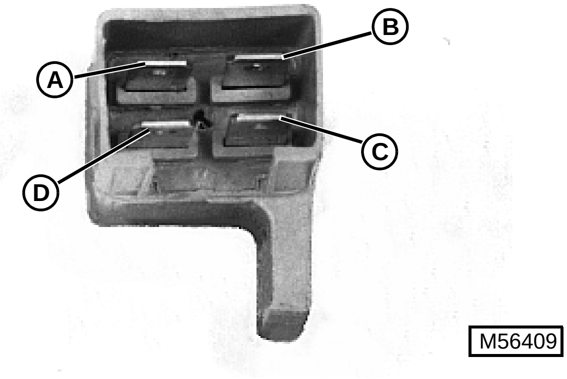
To make sure the brake pedal switch operates properly.

Equipment:

- Ohmmeter

Procedure:

1. Park machine on level surface and turn key switch OFF.
2. Shift lever in NEUTRAL and park brake LOCKED.
3. Disconnect harness connector from brake switch.



4. Check continuity.

Results:

- there should BE continuity between terminals (B and C) when plunger is RELEASED,
- there should NOT BE continuity between terminals (B and C) when plunger is DEPRESSED.
- there should NOT BE continuity between terminals (A and D) when plunger is RELEASED,
- there should BE continuity between terminals (A and D) when plunger is DEPRESSED.
- If continuity is NOT correct, replace switch.

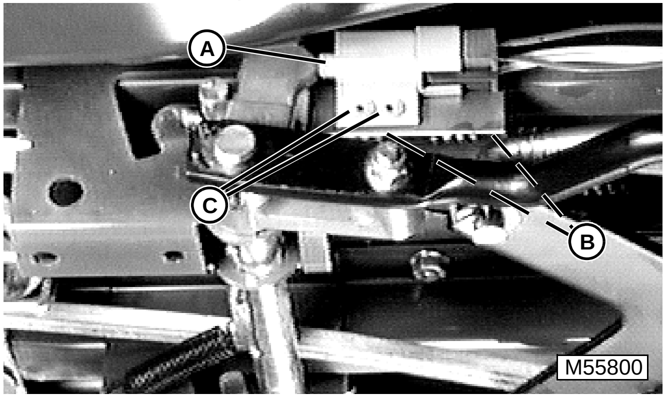
BRAKE SWITCH ADJUSTMENT

Reason:

To ensure proper that engine starts only when brake fully applied.

Procedure:

1. Depress brake pedal and set park brake.



2. Check condition of both mounting rivets (C). If not tight, damaged, or improperly installed, they could affect adjustment and function of start and safety circuits. If rivets are bad, go to Step 3; if rivets are good, go to Step 4.
3. Disconnect harness connector and remove switch assembly to bench vise. Remove rivets, as necessary, using a 4.76 mm (3/16 in.) drill bit and replace with 4.75 x 14.61 mm (0.187 x 0.575 in.) aluminum pop rivets (M67899). Loosely install switch and solidly connect harness connector.
4. Loosen switch bracket hardware (B).
5. Move switch until plunger (A) is about 3 mm (1/8 in.) from bottoming.
6. Check that switch does not bottom when brake pedal fully depressed. Increase clearance if needed.
7. Tighten bracket hardware.
8. Check switch operation.

- Engine should NOT turn over or start when brake pedal is NOT depressed.
- Engine should turn over and start when brake pedal is fully depressed.
- If operation is not correct, test switch.

HEADLIGHT SWITCH TEST (OPTIONAL)

Reason:

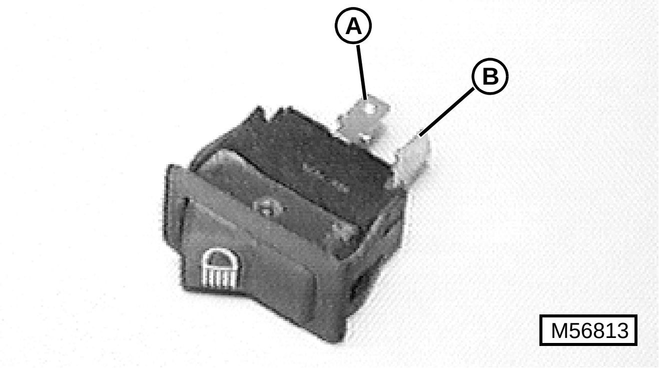
To make sure the headlight switch terminals have continuity when the headlight switch is **ON**.

Equipment:

- Ohmmeter or Continuity Tester

Procedure:

1. Park machine on level surface and turn key switch OFF.
2. Shift lever in NEUTRAL and park brake LOCKED.
3. Disconnect headlight switch connector.



4. Move headlight switch to the ON and then the OFF position. Check continuity between terminals (A and B).

Results:

- Terminals should have continuity with switch on.
- Terminals should NOT have continuity with switch off.
- If continuity is NOT correct, replace headlight switch.

KEY SWITCH TESTS

Reason:

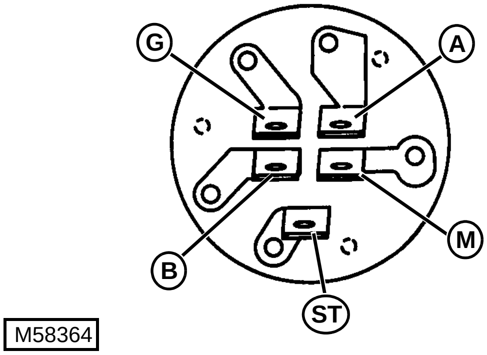
To verify key switch functions are operating properly.

Equipment:

- Ohmmeter or Continuity Tester

Procedure:

1. Park machine on level surface and turn key switch OFF.
2. Shift lever in NEUTRAL and park brake LOCKED.
3. Disconnect key switch connector.



NOTE: Key switch terminals are identified to coincide with electrical schematic designations.

4. Use an ohmmeter to test switch continuity in OFF, RUN, and START positions.

Specification:

Key Switch Continuity

Switch Position	Terminal Continuity
OFF	**(G and M)**
RUN	**(A and B)**
START	**(A and B and ST)**

Results:

- If any continuity is NOT correct, replace switch.

PTO SWITCH TESTS

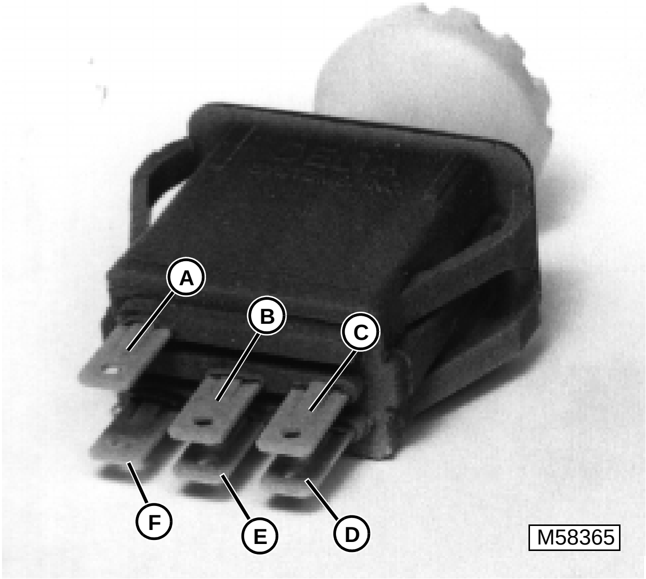
IMPORTANT: PTO switch can fail from prolonged exposure to moisture. Original switch has seven terminals not six. The extra terminal is not needed for STX application.

Reason:

To make sure terminal continuity is correct in the ON and OFF positions.

Equipment:

- Ohmmeter or Continuity Tester



Connections:

1. Put transaxle in neutral.
2. Engage park brake.
3. Put key switch in OFF position.
4. Disconnect PTO switch harness connector.

Procedure:

1. Put PTO switch in OFF position.
2. Check for continuity between terminals (A and F) only.
3. Put PTO switch in ON position.
4. Check for continuity between terminals (B and E) and (C and D).

Specifications:

PTO switch OFF continuity . . . . terminals (A and F)
PTO switch ON continuity
. . . . terminals (B and E) and (C and D)

Results:

- If continuity is not to specification, replace the PTO switch.

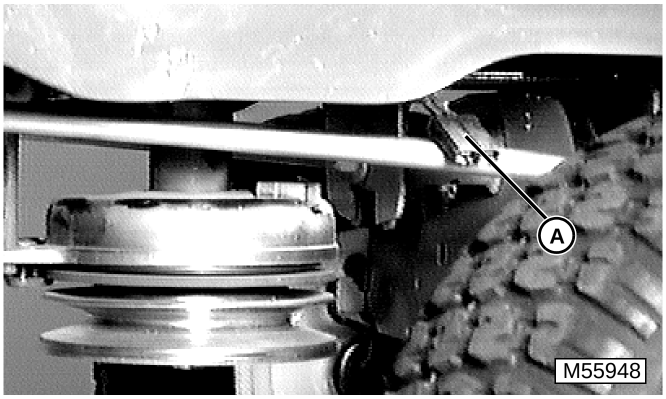
PTO CLUTCH TEST

Reason:

To check operation of PTO clutch coil.

Equipment:

- Jumper Wire
- Ohmmeter



Connections:

1. Put transaxle in neutral.
2. Engage park brake.
3. Put key switch in OFF position.
4. Disconnect PTO clutch connector (A).

Procedure:

1. Connect jumper wire to negative battery terminal and PTO clutch terminal.
2. Connect jumper wire to positive battery terminal and PTO clutch terminal.

Results:

- PTO must engage. If clutch does not engage or does not release when power removed, perform coil resistance test:

PTO Coil Resistance

3. Remove jumpers to PTO clutch.
4. Connect ohmmeter to PTO terminals and test resistance of coil.

Results:

- Resistance should range between 3-10 ohms, if not, replace the PTO clutch.

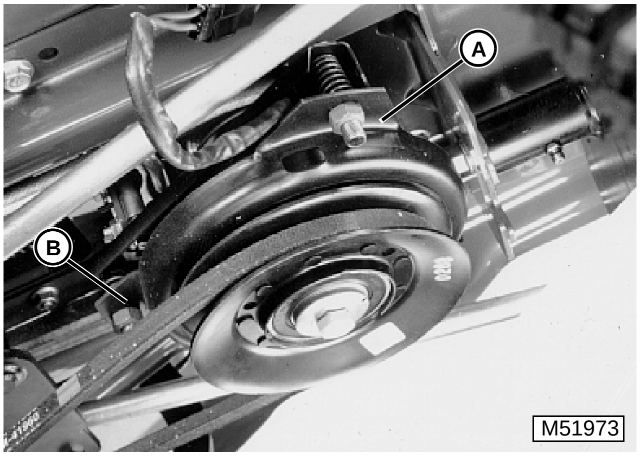
PTO CLUTCH AIR GAP STX30 & STX38 (SN —210000)

Reason:

To set the PTO clutch air gap at a specific dimension for proper operation.

Procedure:

1. Put transaxle in neutral.
2. Put key switch and PTO switch in off position.
3. Engage park brake.



4. Insert feeler gauge through slot (A) in brake plate to check PTO clutch air gap. Gauge should be between clutch armature and rotor. Check air gap at all three slots.

Specifications:

PTO clutch air gap
Warner. . . . . 0.38—0.64 mm (0.015—0.025 In.)
Ogura. . . . . 0.30—0.51 mm (0.012—0.020 in.)

Results:

- If the PTO clutch air gap is not correct, adjust lock nut (B) until the feeler gauge begins to bind between the armature and rotor. Use a sweeping motion with feeler gauge while making this adjustment. DO NOT overtighten nut.
- Repeat procedure on other two adjusting nuts.
- Engage and disengage the PTO clutch several times. Recheck adjustment.

FLYWHEEL MAGNETS

Reason:

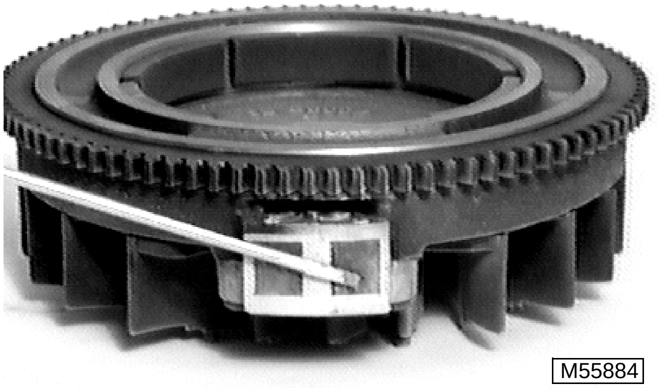
To make sure flywheel magnet(s) have enough force to induce current in ignition coil and stator.

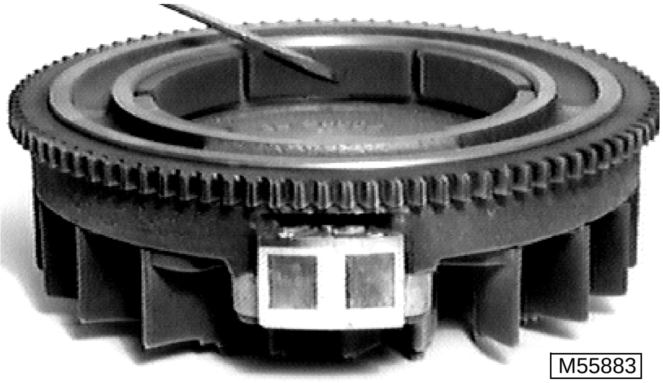
Equipment:

- Screwdriver

Procedure:

1. Park machine on level surface and turn key switch OFF.
2. Shift lever in NEUTRAL and park brake LOCKED.
3. Remove flywheel housing and flywheel from engine.





4. Place screwdriver about 25 MM (1 in.) from magnets.

Results:

- If screwdriver pulled into magnet, flywheel is good.
- If screwdriver is NOT pulled into magnet, flywheel is bad and should be replaced.

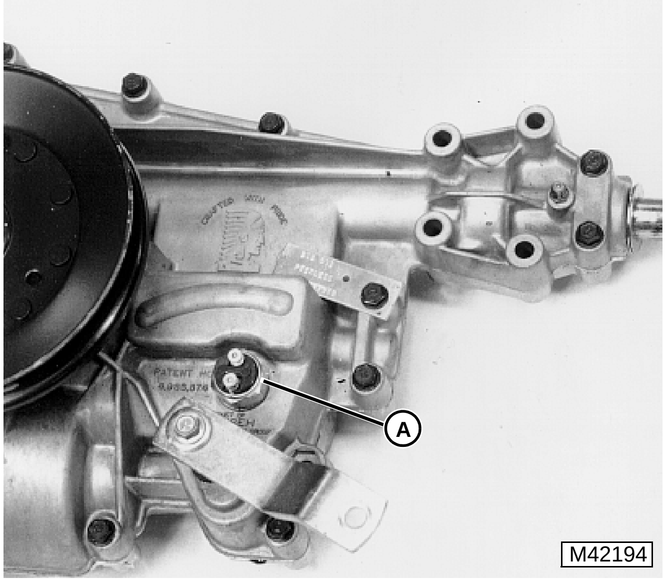
TRANSMISSION NEUTRAL SWITCH STX30 & STX38 (—210000)

Reason:

To make sure tractor cannot be started while in gear.

Procedure:

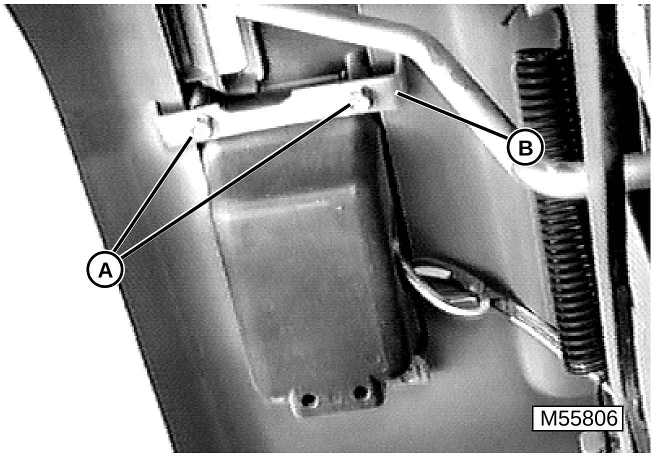
1. Remove spark plug wire and raise rear tire.



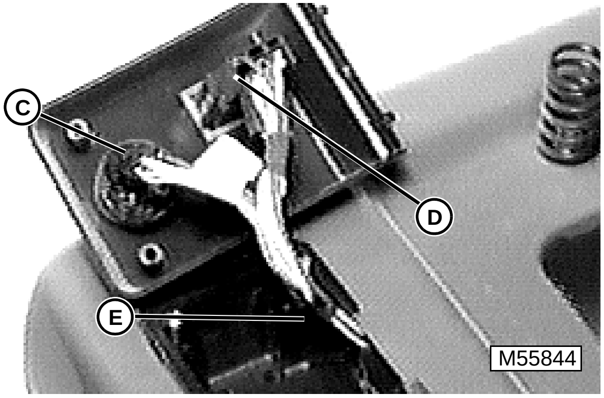
2. Attempt to start engine while moving gear shift lever towards reverse or forward gear. If wheels rotate during cranking, readjust neutral switch by turning switch out slightly.
3. Connect spark plug wire.

REPAIR

REMOVE AND INSTALL KEY SWITCH AND PTO SWITCH



1. Remove retaining screws (A) and Bracket (B).

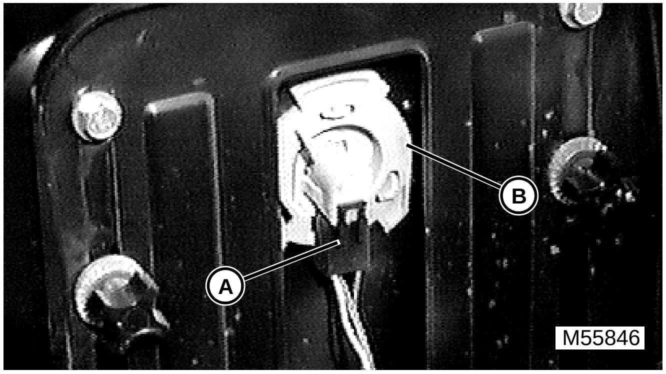


2. Remove key switch connector (C) or PTO connector (D).

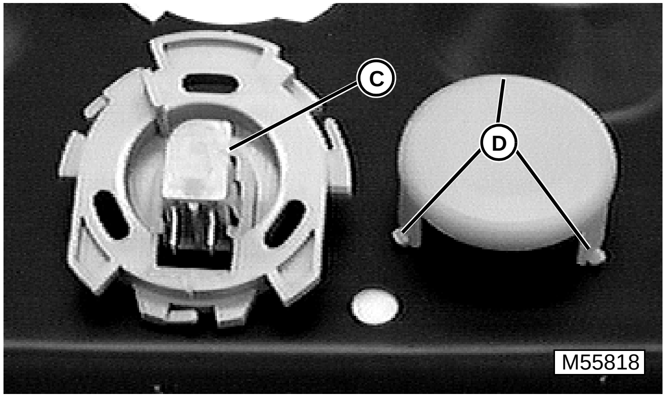
NOTE: Extra power and ground leads (E) are for accessories.

REMOVE AND INSTALL SEAT SWITCH

NOTE: Seat switch connector has an internal spring which will short cavities of connector together when it is disconnected from seat switch. This prevents operator from defeating seat switch by leaving connector disconnected.



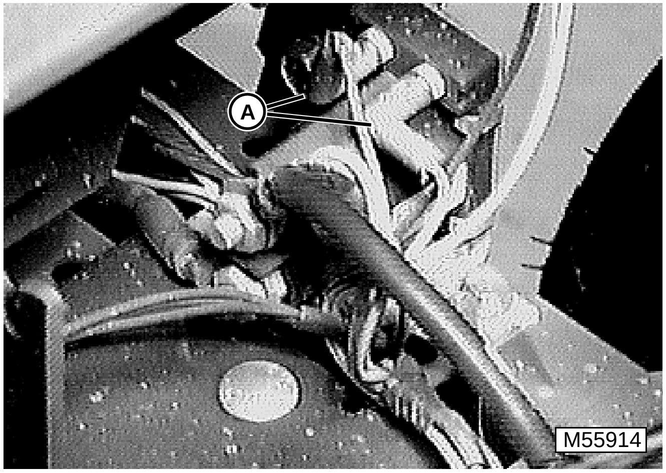
1. Tilt seat forward.
2. Disconnect connector (A).
3. Rotate switch assembly (B) counterclockwise to remove switch from seat pan.



4. Depress tabs (D) of cover and remove.
5. Unsnap switch (C) from housing.
6. Assemble in reverse order of disassembly.

REMOVE AND INSTALL STARTER SOLENOID

NOTE: Relay in located at the right-hand front corner of battery compartment.

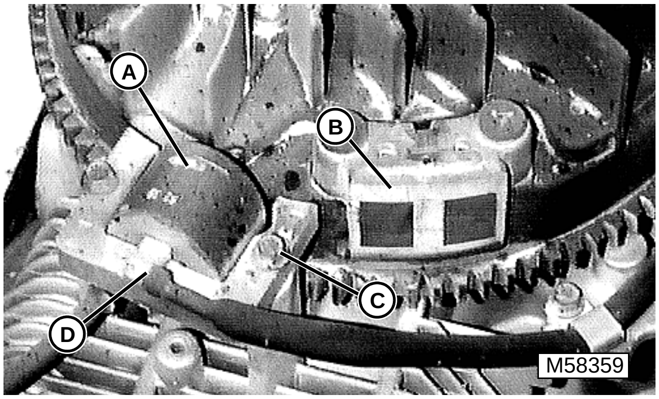


1. Remove battery.
2. Disconnect all wires and remove solenoid.

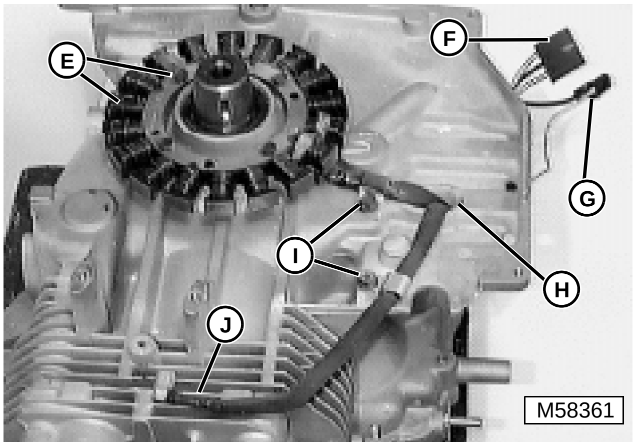
NOTE: When installing connectors to solenoid, make sure both barrel terminals (A) are pushed all-the-way on so they stay locked onto their stud.

3. Assemble in reverse order of disassembly.

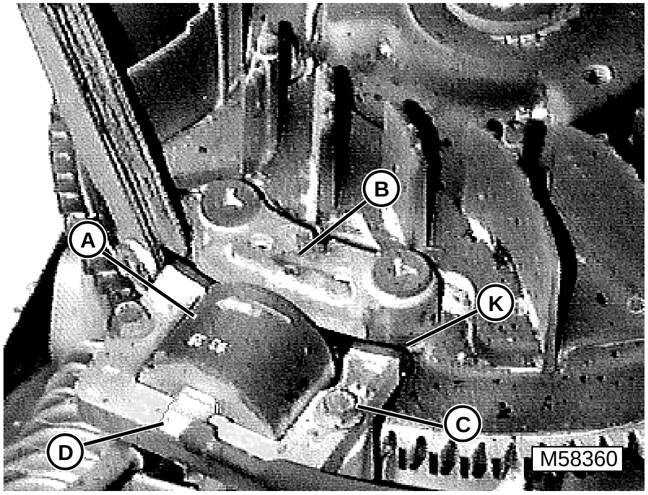
REMOVE AND INSTALL STATOR AND IGNITION MODULE



1. Turn flywheel magnet (B) away from ignition module (A).
2. Disconnect wire (D) from terminal.
3. Remove cap screws (C) and ignition module.
4. Remove flywheel (see Remove and Install Flywheel in Engine Repair group).



5. Remove two white stator wires from connector (F).
6. Remove clamps (G).
7. Remove cap screws and stator (E).
8. Inspect for damage.
9. Thread stator wires through hole in crankcase and install in connector. Fasten clamps.
10. Install stator. Tighten cap screws to specification.
11. Install flywheel and tighten cap screw to specification (see Remove and Install Flywheel in Engine Repair section).
12. Rotate magnet away from module mount. Install module loosely.



13. Align flywheel magnet (B) with mounting posts for ignition module.
14. Place **0.25 mm (0.01 in.)** feeler gauge blade (K) or shim stock across magnet face.

IMPORTANT: BE SURE flywheel magnet (B) is centered on ignition module (A) so all three polls of the ignition module are properly gapped from the flywheel magnet.

15. Position ignition module (A) so all three polls mate with feeler gauge blade (K) and its two mounting holes align with mounting posts.

Continued on next page

16. Install and tighten cap screws to specification.
17. Remove feeler gauge and connect wire (D) to terminal.

Specifications:

Ignition Module Air Gap . . . . 0.25mm (0.01 in.)
Ignition Module Cap Screws
. . . . . 4.0—6.2 N•m (35–55 lb-in.)
Stator Cap Screws . . . . 4 N•m (35 lb-in.)
Flywheel Cap Screw . . . . 68 N•m (50 lb-ft)

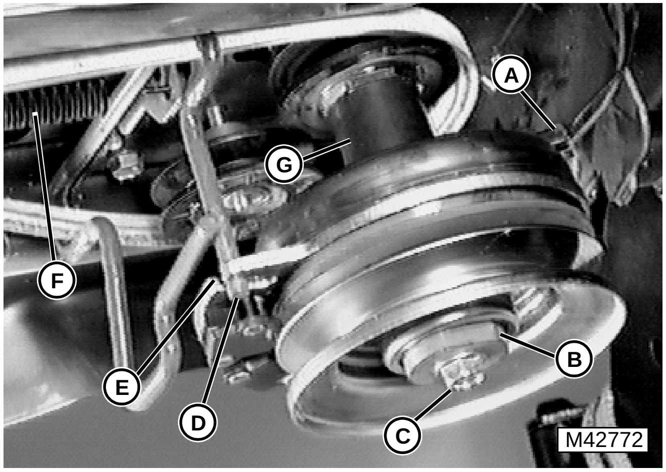
REPAIR PTO CLUTCH

NOTE: *If there excessive vibration in PTO clutch area and noise coming from vibration between PTO clutch and pin see step 5.*

Removal:

1. Lower mower deck and remove mower deck drive belt from PTO clutch sheave.

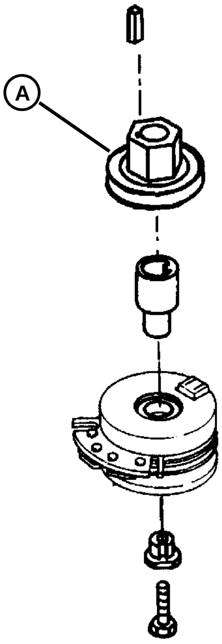
NOTE: *PTO clutch is not serviceable, entire clutch must be replaced. Drive sheave is serviceable. Gear drive unit shown, hydrostatic version uses same procedure.*



2. Disconnect electrical connector (A).
3. Disengage traction drive belt tension spring (F).

NOTE: *To remove cap screw (C) keep crankshaft from turning using flats of bushing/washer (B).*

4. Remove cap screw (C), bushing/washer (B), PTO clutch assembly, and spacer (G).



M85806

5. STX38 (M00STXC210000—270000)
   STX38 (M00STXD210000—270000)
   STX38 (M00STXE240000—270000)
   STX46 (M00STXF240000—270000)
   STX46 (M00STXG240000—270000)
   The relationship between the hub ends and bore of the drive sheave is critical. Drive sheave (A) hub ends must be perpendicular to bore. Replacement of the drive sheave (A) in most cases will solve the vibration problem. If drive sheave replacement does not reduce vibration, then check crankshaft alignment.

Installation:

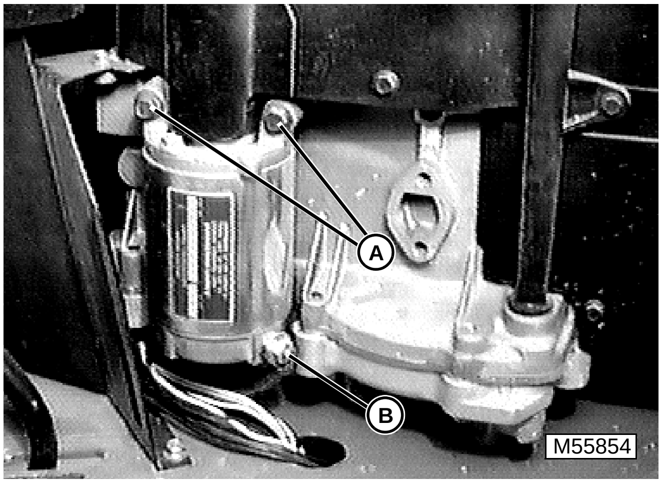
NOTE: *Coat crankshaft, inside of spacer (G), and inside bore of PTO clutch with NEVER-SEEZ before installing spacer (G) and PTO clutch assembly.*

6. Install spacer (G) and PTO clutch on crankshaft so pin (D) of belt guide sticks through anchor slot (E) of clutch.
7. Tighten cap screw (C) to specification**.**
8. Align traction drive belt with sheave and engage traction drive belt tension spring (F).
9. Connect wire connector (A).
10. Install mower deck drive belt.

Specification:

PTO Clutch Assembly Cap Screw
. . . . . 75 N•m (55 lb-ft)

REMOVE AND INSTALL STARTER



NOTE: Some starters may have a relay located at the right-hand rear corner of battery compartment. When installing connector to relay, make sure all barrel terminals stay locked on connector stud.

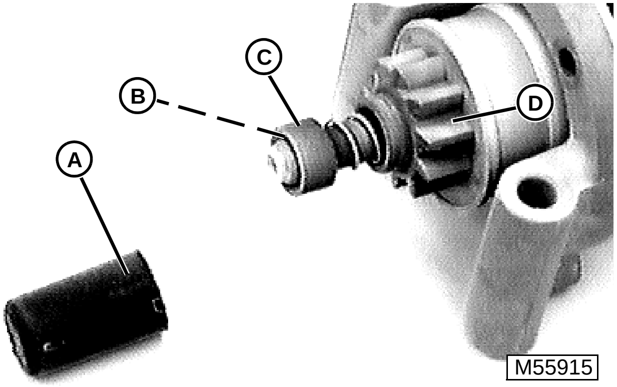
1. Disconnect negative battery cable.
2. Disconnect starter cable (B) from starter.
3. Remove starter cap screws (A) and starter.
4. Install starter and cap screws to specification.
5. Clean and fasten starter cable (B) to starter.
6. Clean and connect negative battery cable.

Specification:

Starter Cap Screws . . . . 24 N•m (216 lb-in.)

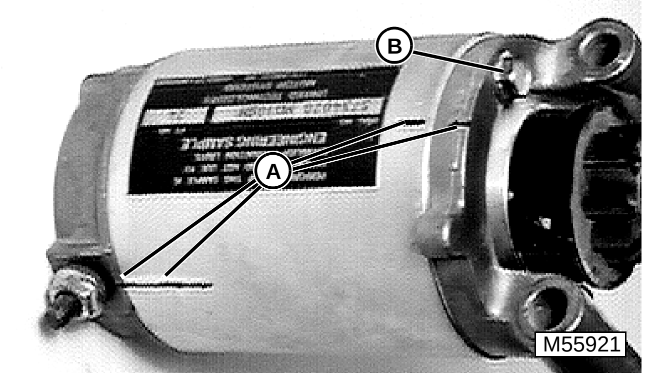
REPLACE BENDIX DRIVE

Replace drive if drive fails to engage flywheel or kicks out repeatedly before engine starts.



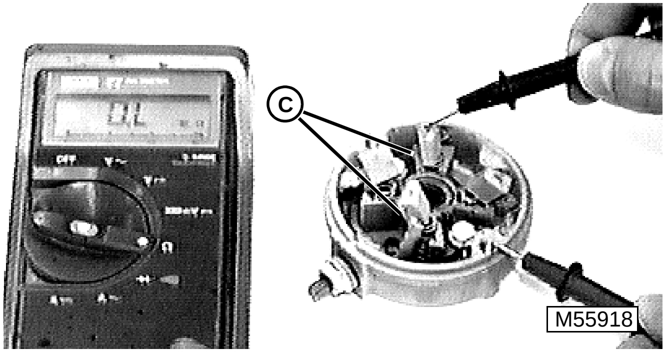
1. Remove dust cover (A).
2. Compress retainer (C) and remove stop clip (B).
3. Disassemble bendix drive (D).
4. Inspect and replace with new Bendix Drive Kit.

REPAIR STARTER AND REPLACE BRUSHES

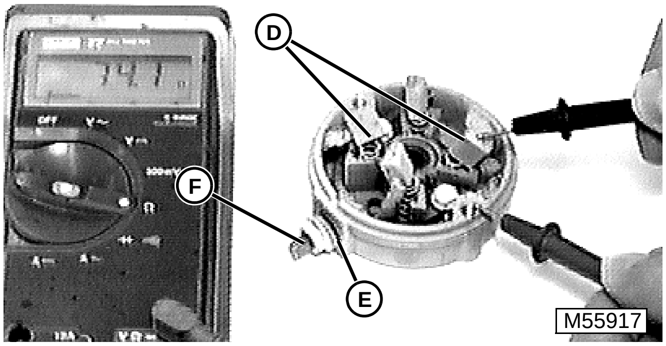


NOTE: Highlight upper and lower marks (A) on frame and end caps to aid assembly. Permanent magnets are part of frame. If frame or magnets are damaged replace frame. Always test armature anytime starter is disassembled (see Armature Test on next page).

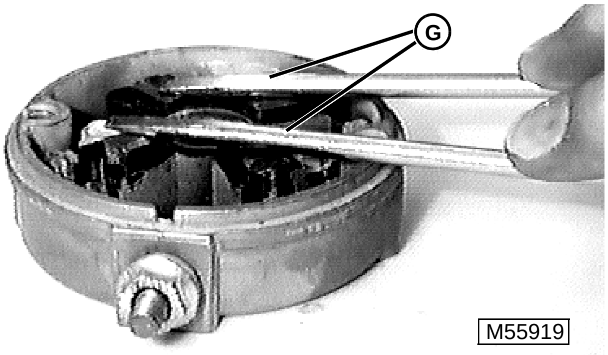
1. Remove long cap screws (B) then separate top end cap and armature from frame and bottom end cap (brush holder).
2. Clean commutator of armature with a coarse, lint free cloth. DO NOT use emery cloth. If commutator is badly grooved, turn it down on a lathe or replace it.



3. Clean negative brushes (C) contact point with end cap. Using Ohmmeter, check for **continuity** with end cap. Replace negative brushes if **no continuity** is indicated.



4. Clean stud terminal (F), replace if threads are stripped or if it is corroded.
5. Replace insulator (E) if cracked.
6. Clean positive brushes (D)contact point with end cap. Using Ohmmeter, check for **no continuity** between positive brushes (D) and end cap, and also between stud terminal (F) and end cap. Replace positive brushes (D) if **continuity** is indicated.

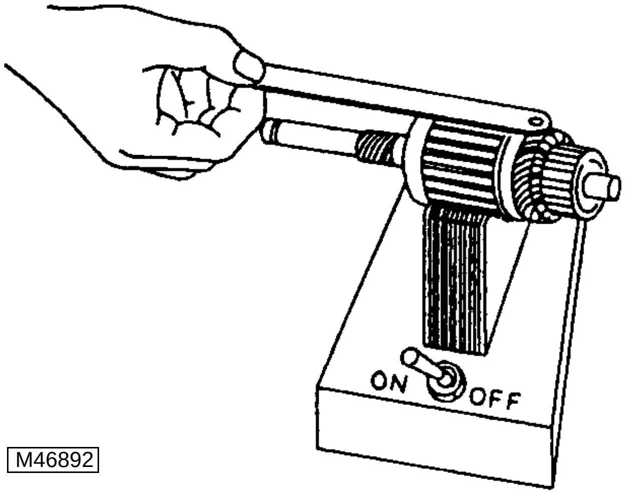


7. Align upper highlighted markings (A) and carefully assemble top end cap and armature into frame.
8. Compress brushes into brush holders of bottom end cap using two thin screw drivers (G) or tongue depressors.
9. Align lower highlighted markings (A) and carefully assemble starter so brushes are positioned against commutator of armature.
10. Carefully remove screwdrivers without allowing brushes to dislodge from holders of bottom end cap as assembly goes together.
11. Install long cap screws (B) and tighten them evenly.
12. Install starter in reverse order of removal.

REPAIR STARTER ARMATURE

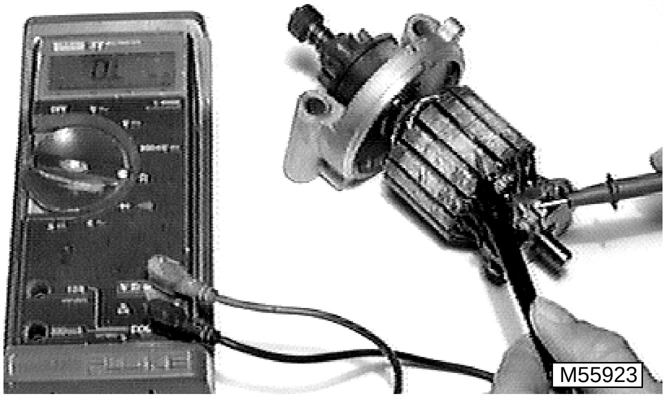
IMPORTANT: DO NOT clean armature with solvent. It can damage insulation on windings. Use mineral spirits and a clean brush.

1. Clean commutator of armature with a coarse, lint free cloth. DO NOT use emery cloth. If commutator is badly grooved, turn it down on a lathe or replace it.
2. Check for short circuits with a growler.

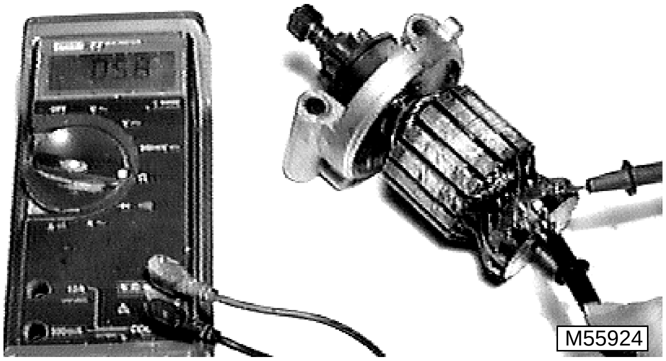


3. Rotate armature on growler while holding a steel strip (e.g. hacksaw blade) on armature. Strip will vibrate in area of short.

NOTE: Shorts between bars are sometimes caused by dirt or copper between bars.
If test indicates short circuited windings, clean and recheck. If still faulty, replace armature.



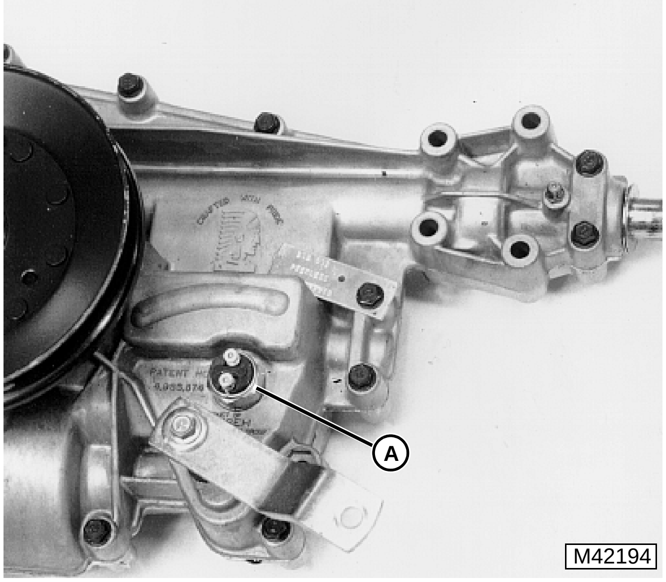
4. Check for grounded windings with an ohmmeter or test light. If any **continuity** is indicated, winding is grounded and armature must be replaced.



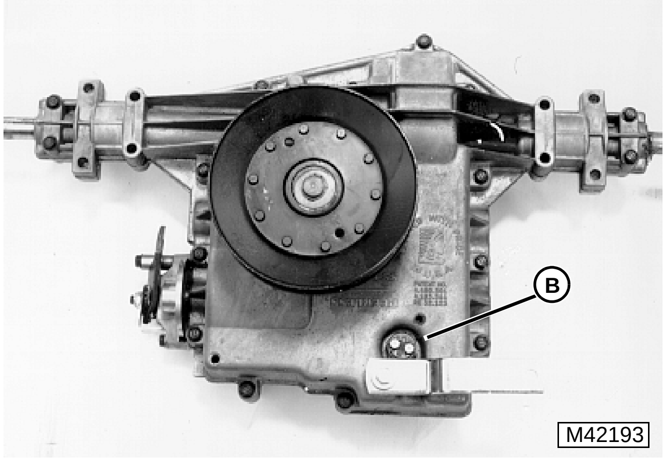
NOTE: Armature windings are connected in parallel, each bar must be tested.

5. Check for open windings with an ohmmeter or test light. If **no continuity** is indicated, there is an open circuit and armature must be replaced.

REMOVE AND INSTALL TRANSMISSION NEUTRAL SWITCH STX30 & STX38 (SN —210000)



1. Early Models—Clean off debris from around neutral switch (A).



1. Late Models—Clean off debris from around neutral switch (B).
2. Disconnect wire lead.
3. Remove switch and O-ring.
4. Install O-ring on switch.

IMPORTANT: Install correct switch. Zinc plated switch (A) for the early model transmissions is normally open. Brass colored switch (B) for late model transmissions is normally closed.

⚠ CAUTION

If neutral switch (B) on Late Model transmissions is turned down too far, vehicle could start in partial gear. Perform neutral switch adjustment.

5. With transmission in neutral, turn switch down until switch just shows continuity between the two terminals. (Use ohmmeter or continuity light). Turn switch down an additional 1/4 minimum to 3/4 maximum turn until switch terminals line up with wire lead.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Dimensions:

Overall Axle Width (end-to-end)	735.432 mm (28.954 in.)
Overall Case Width	432.562 mm (17.030 in.)
Overall Case Length (front-to-rear)	272.034 mm (10.710 in.)
Overall Height (top of input shaft-to-bottom case)	183.400 mm (7.220 in.)
Overall Case Height (top case-to-bottom case)	154.178 mm (6.070 in.)

Gear Teeth—STX30 (SN —135158) (SN 160759—) &
STX38 (SN —139614)) (SN 185587—210000)
Peerless Model 920-017, 930-004 & 930-004A:

Bevel Pinion Gear (input shaft)	15
Drive Shaft:	
Bevel Drive Gear	42
Drive Sprocket Gear	9
1st Gear	12
2nd Gear	16
3rd Gear	20
4th Gear	23
5th Gear	28
Spur Gear	14
Intermediate Shaft:	
Drive Sprocket Gear	18
1st Gear	37
2nd Gear	34
3rd Gear	30
4th Gear	27
5th Gear	22
Differential Spur Gear	32
Differential Miter Bevel Gears (axle shafts)	15
Differential Miter Bevel Gears (cross shaft)	15

Gear Teeth—STX30 (SN 135159—160758) & STX38 (SN 139615—185586)
Peerless Model 915-012A/915-012B:

Bevel Pinion Gear (input shaft)	11
Drive Shaft:	
Bevel Drive Gear	44
Drive Sprocket Gear	9
1st Gear	15
2nd Gear	20
3rd Gear	23
4th Gear	19
5th Gear	19
Spur Gear	16
Intermediate Shaft:	
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1st Gear	35
2nd Gear	30
3rd Gear	27
4th Gear	21
5th Gear	31
Differential Spur Gear	34
Differential Miter Bevel Gears (axle shafts)	15
Differential Miter Bevel Gears (cross shaft)	15

Gear Teeth—STX38 (SN 210001—) & STX46:

Bevel Pinion Gear (input shaft)	14
Bevel Pinion Gear (input shaft) STX38 (SN 301383—)	12
Drive Shaft:	
Bevel Drive Gear	42
Bevel Drive Gear STX38 (SN 301383—)	36
Drive Sprocket Gear	9
1st Gear	12
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Drive Sprocket Gear	18
1st Gear	37
2nd Gear	35
3rd Gear	30
4th Gear	27
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Combination Gear (idler shaft)	12 and 35
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Differential Miter Bevel Gears (cross shaft)	15
Differential Miter Bevel Gears (cross shaft) STX38 (SN 301383—)	12

Drive Belt:

Effective Length	
New	2660 ± 8 mm (104.7 ± 0.3 in.)
Minimum	2631 mm (103.6 in.)
Maximum	2710 mm (106 in.)
Top Width	
New	13.5 mm (0.53 in.)
Minimum	11 mm (0.43 in.)
Bottom Width	
New	7.5 mm (0.30 in.)
Minimum	5 mm (0.20 in.)
Depth	
New	9.5 mm (0.37 in.)
Minimum	7 mm (0.28 in.)

Lubrication:

Grease Type	Shell Darina® D
Capacity (grease)	638 gms (1.406 lbs)
Input Shaft Needle Bearings—	
Grease Type	Unirex® N3 (M120263)
Capacity (grease)	2.268 gms (.005 lbs)
Overall Weight (with grease)	14.2 kg (31.3 lbs)

REPAIR SPECIFICATIONS

Wear Tolerances:

Input Shaft—	
Shim:	
Standard	0.63x1.0x0.01—0.082 in.
Wear Limit	Visual Check
Washers:	
Standard	0.63x1.4x0.046 in.
Wear Limit	Visual Check
Intermediate Shaft—	
Flange Bearing:	
Wear Limit	Visual Check
Shim:	
Standard	0.63x1.0x0.01—0.08 in.
Wear Limit	Visual Check
Spacer:	
Standard	1.13x1.45x0.49 in.
Wear Limit	Visual Check
Spacer:	
Standard	1.13x1.5x0.375 in.
Wear Limit	Visual Check
Washer:	
Standard	0.64x0.14x0.06 in.
Wear Limit	Visual Check
Idler Shaft—	
Washers:	
Standard	0.63x1.0x0.03 in.
Wear Limit	Visual Check
Spacer:	
Standard	0.63x1.0x0.17 in.
Wear Limit	Visual Check
Shim:	
Standard	0.63x1.0x0.1—0.08 in.
Wear Limit	Visual Check
Drive Shaft—	
Flange Bearings:	
Wear Limit	Visual Check
Spacer:	
Standard	0.64x0.09x0.76 in.
Wear Limit	Visual Check
Shim:	
Standard	0.76x1.12—1.25x0.01—0.06 in.
Wear Limit	Visual Check
Spacer:	
Standard	0.78x1.0x0.38 in.
Wear Limit	Visual Check
Washers:	
Standard	0.63x1.0x0.06 in.
Wear Limit	Visual Check
Left Axle Shaft—	
Washers:	
Standard	0.76x1.25x0.03 in.
Wear Limit	Visual Check
Shims:	
Standard	0.76x1.12—1.25x0.1—0.06 in.
Wear Limit	Visual Check

Wear Tolerances—continued:

Differential Assembly—	
Bevel Gear Cross Shaft:	
Wear Limit	Visual Check
Right Axle Shaft—	
Shims:	
Standard	0.76x1.12—1.25x0.01—0.06 in.
Wear Limit	Visual Check
Brake Assembly—	
Thin Friction Puck:	
Wear Limit	Visual Check
Brake Disc:	
Wear Limit	Visual Check
Thick Friction Puck:	
Wear Limit	Visual Check

TORQUE SPECIFICATIONS (ALPHABETICAL ORDER)

Brake Assembly Mounting Cap Screws	18.1—22.6 N•m (160—200 lb-in.)
Clutch Bellcrank Mounting Cap Screw	34±7 N•m (300±60 lb-in.)
Detent Ball and Spring Set Screws	Flush Only
Gear Shift Lever Cap Screws	13.5—17.6 N•m (120—156 lb-in.)
Hanger Bracket to Frame Cap Screws (Front)	15 N•m (132 lb-in.)
PTO Clutch to Crankshaft Cap Screw	75 N•m (55 lb-ft)
Shift Linkage Lock Nut	15 N•m (132 lb-in.)
Transaxle Housing Cap Screws	9—10 N•m (100—125 lb-in.)
Transaxle Mounting Cap Screws to Hanger Bracket (Front)	15 N•m (132 lb-in.)
Transaxle Mounting Cap Screws to Frame (Rear)	20.3—47.4 N•m (180—420 lb-in.)

ENGINE OUTPUT SHAFT LUBRICATION SPECIFICATIONS

Engine Output Shaft	John Deere Never-Seez®
Engine Traction Drive Sheave	John Deere Never-Seez®
PTO Clutch Assembly	John Deere Never-Seez®

OTHER MATERIALS

Input Shaft Needle Bearings Grease	Unirex® N3 Grease
Transaxle Housing Grease	Shell Darina® D Grease
Transaxle Sealant—	John Deere Form-In-Place Gasket Silicone Sealant

SERVICE PART KITS (ALPHABETICAL ORDER)

Use Parts Manual For Specific Information

Brake Friction Puck Assembly Kit

Clutch Keys Assembly Kit

Combination Gear Assembly Kit

Detent Assembly Kit

Differential Miter Gear Assembly Kit

Differential Ring Gear Assembly Kit

Drive Chain and Sprocket Assembly Kit

Drive Shaft Assembly Shim Kit

Input Shaft Assembly Kit

Input Shaft Assembly Shim Kit

Pinion and Gear Assembly Kit

Transaxle Assembly Kit (Complete)

1st Gear Set Assembly Kit

2nd Gear Set Assembly Kit

3rd Gear Set Assembly Kit

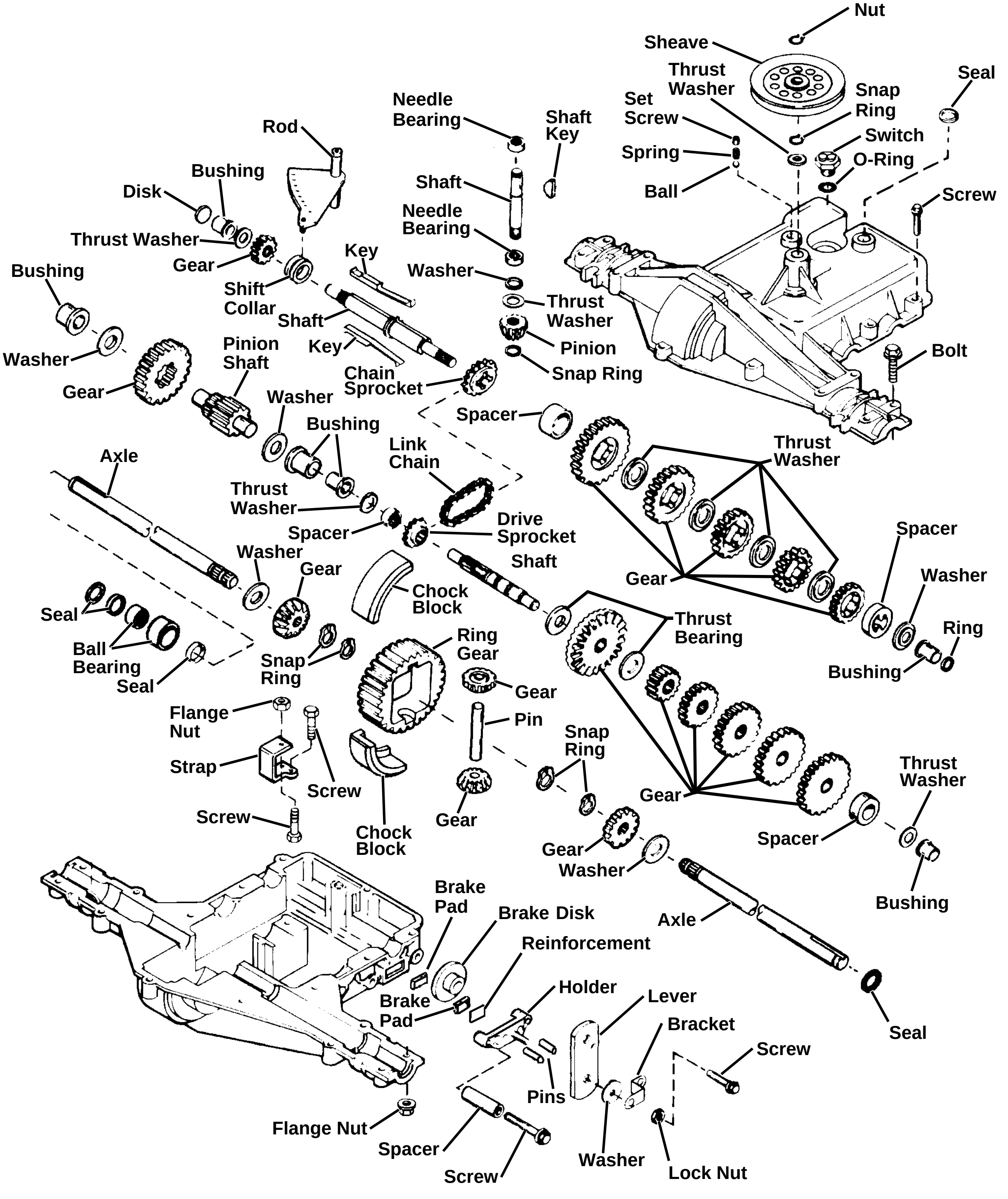
4th Gear Set Assembly Kit

5th Gear Set Assembly Kit

NOTES

COMPONENT LOCATION

TRANSAXLE—PEERLESS MODEL 920-017
STX30 (SN —135158) (SN 160759—)
STX38 (SN —139614) (SN 185587—210000)



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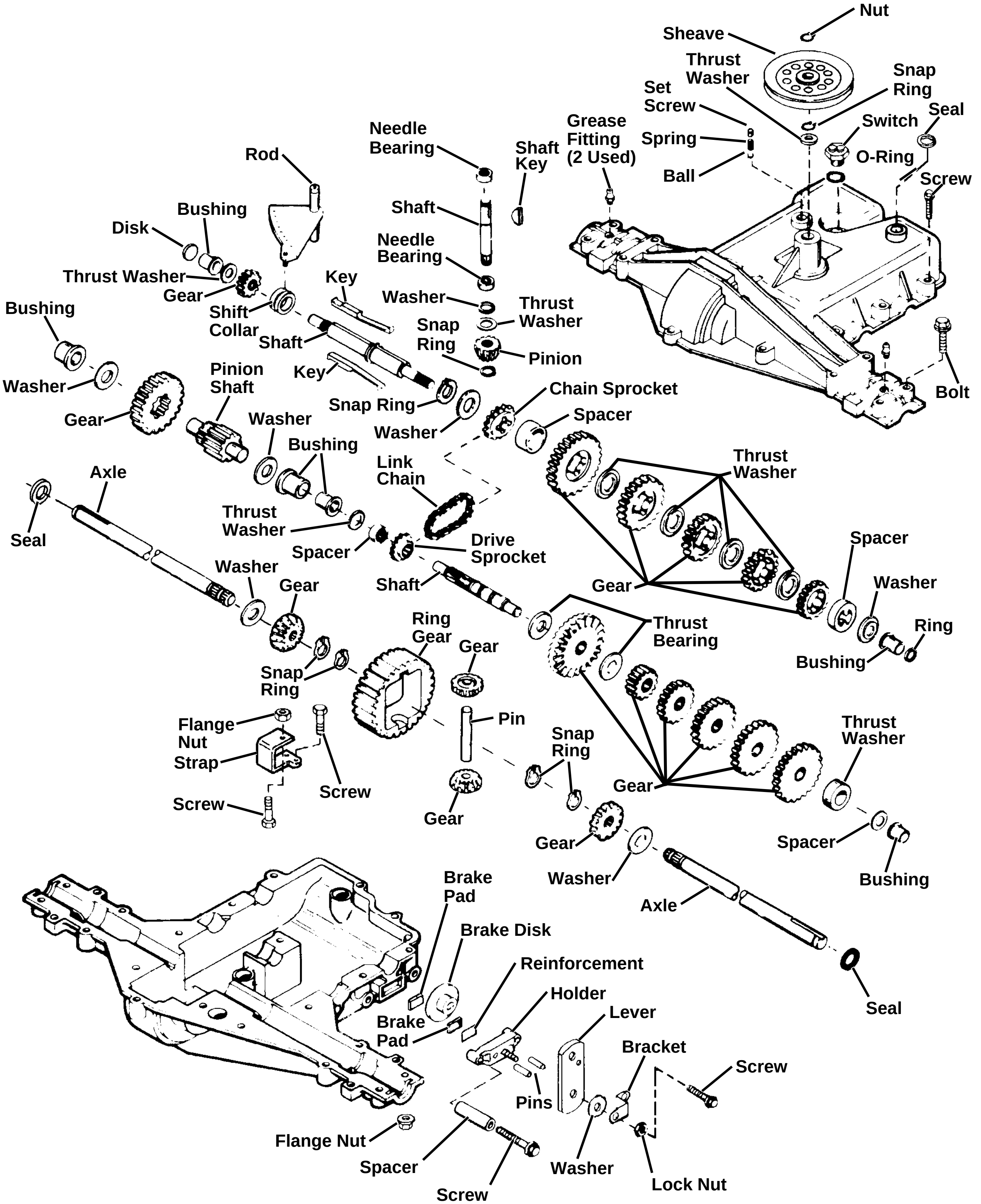
TRANSAXLE—PEERLESS MODEL 930-004 & 930-004A STX30 (SN —135158) (SN 160759—) STX38 (SN —139614) (SN 185587—210000)



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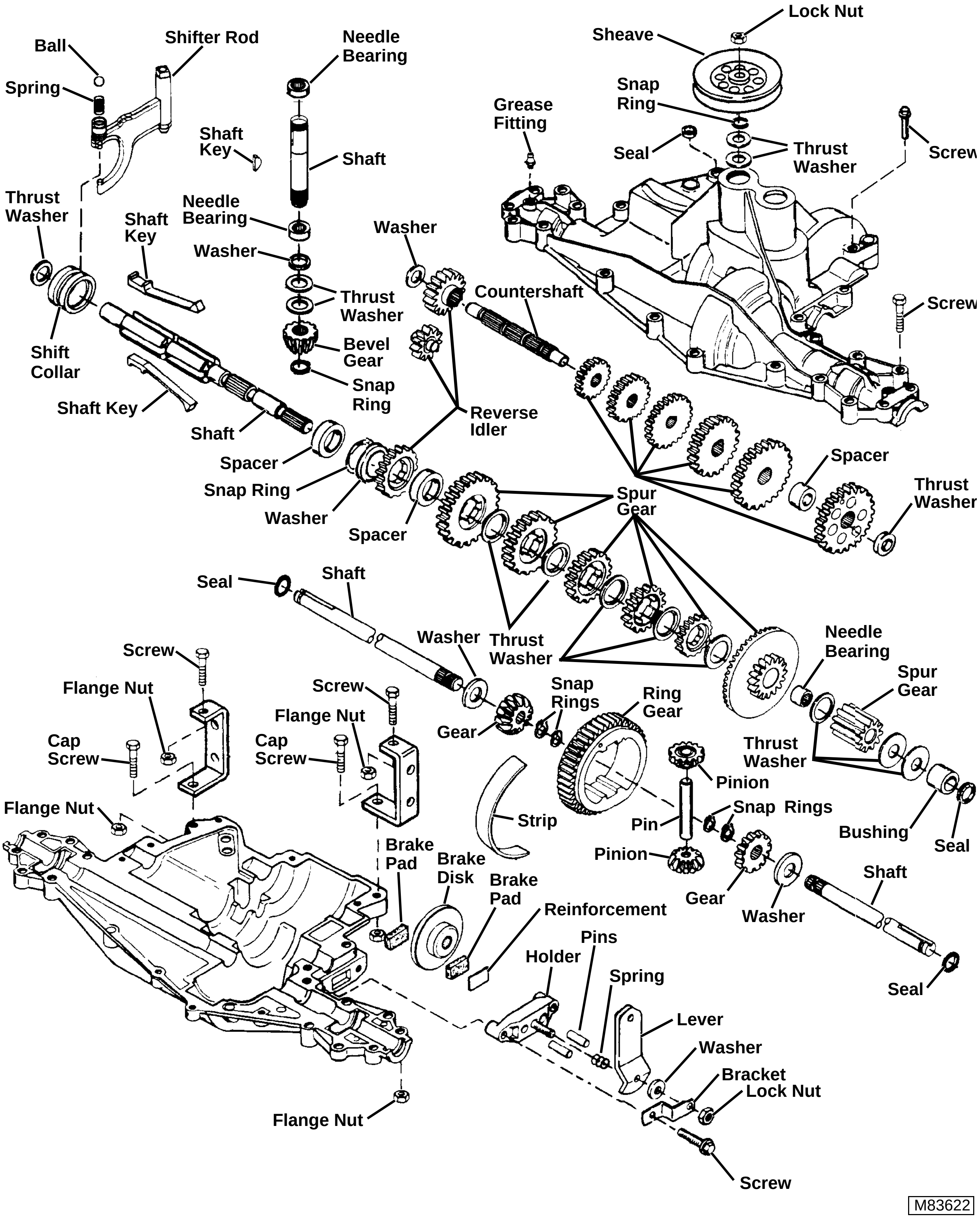
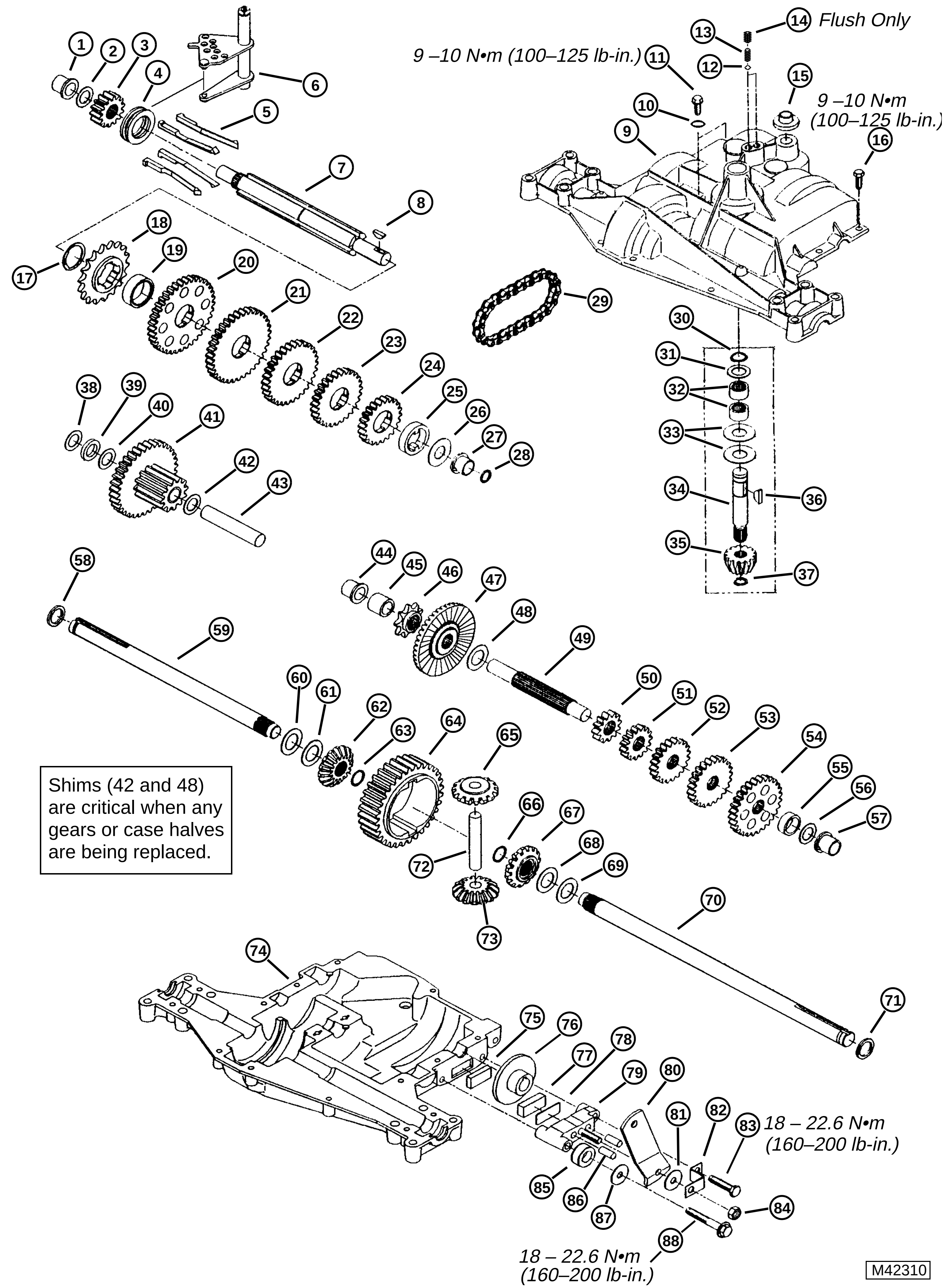
TRANSAXLE—PEERLESS MODEL 915-012A & 915-012B STX30 (SN 135159—160758) STX38 (SN 139615—185586)



TRANSAXLE—DANA 5-SPEED
STX38 (SN 210001—301382)
STX46

1. Flange bearing
2. Shim (0.632x1.00x0.010–0.082 in.)
3. Spur gear (14 teeth)
4. Shift collar
5. Shift key (4 used)
6. Shifter Fork
7. Intermediate shifter/brake shaft
8. Woodruff key
9. Upper case housing
10. O-ring seal (2 used)
11. Screw (2 used) (1/4x0.734–20 in.)
12. Detent ball (2 used)
13. Detent spring (2 used)
14. Set screw (2 used) Flush Only
15. Shifter shaft rubber boot
16. Screw (14 used) (1/4x0.734–20 in.)
17. Retaining ring
18. Drive chain large sprocket /reverse gear (18 teeth)
19. Spacer (1.131x1.45x0.494 in.)
20. Intermediate shaft 1st gear (37 teeth)
21. Intermediate shaft 2nd gear (35 teeth)
22. Intermediate shaft 3rd gear (30 teeth)
23. Intermediate shaft 4th gear (27 teeth)
24. Intermediate shaft 5th gear
    (SN 210001—270000 & Export)—22 teeth
    (SN 270001—   )—26 teeth
25. Spacer w/internal keys (1.133x1.50x0.375 in.)
26. Washer (0.640x0.137x0.061 in.)
27. Flange bearing
28. Square-cut rubber seal (open lip to inside)
29. Drive chain (24 pitches)
30. Retaining ring
31. Shim (0.632x1.00x0.010–0.082 in.)
32. Needle bearing (2 used)
33. Washer (2 used) (0.640x1.38x0.061 in.)
34. Input shaft
35. Bevel pinion gear (14 teeth)
36. Woodruff key
37. Retaining ring
38. Washer (0.632x1.00x0.026 in.)
39. Spacer (0.630x1.00x0.169 in.)
40. Washer (0.632x1.00x0.026 in.)
41. Idler gear (12 & 35 teeth)
42. Shim (0.632x1.00x0.010–0.082 in.)
43. Idler shaft
44. Flange bearing
45. Spacer (0.635x0.87x0.755 in.)
46. Drive chain drive sprocket (9 teeth)
47. Drive shaft bevel gear (42 teeth)
48. Shim (0.758x1.12–1.25x0.010–0.062 in.)
49. Drive shaft
50. Drive shaft 1st gear (12 teeth)
51. Drive shaft 2nd gear (15 teeth)
52. Drive shaft 3rd gear (20 teeth)
53. Drive shaft 4th gear (23 teeth)
54. Drive shaft 5th gear
    (SN 210001—270000 & Export)—28 teeth
    (SN 270001—   )—24 teeth
55. Spacer (0.781x1.00x0.375 in.)
56. Washer (0.632x1.00x0.060 in.)
57. Flange bearing
58. Square-cut rubber ring
59. Left axle shaft
60. Washer (0.758x1.25x0.031 in.)
61. Washer (0.758x1.25x0.031 in.)
62. Differential bevel gear (15 teeth)
63. Retaining ring
64. Differential ring gear (32 teeth)
65. Differential bevel gear (15 teeth)
66. Retaining ring
67. Differential bevel gear (15 teeth)
68. Shim (0.758x1.12–1.25x0.010–0.062 in.)
69. Shim (0.758x1.12–1.25x0.010–0.062 in.)
70. Right axle shaft
71. Square-cut rubber ring
72. Differential cross shaft
73. Differential bevel gear (15 teeth)
74. Lower case housing
75. Thin friction puck
76. Brake disc (rotor)
77. Thick friction puck
78. Friction puck striker plate
79. Brake housing
80. Brake lever
81. Washer (0.321x1.00x0.055 in.)
82. Lever stop bracket
83. Cap screw (5/16x1.44–18 in.)
84. Lock nut (5/16–24 in.)
85. Lever Stop bushing (0.604x1.076x0.395 in.)
86. Actuator dowel pin (2 used)
87. Washer (0.321x1.00x0.055 in.)
88. Cap screw (5/16x2.25–18 in.)



Flush Only

9 –10 N•m (100–125 lb-in.)

9 –10 N•m (100–125 lb-in.)

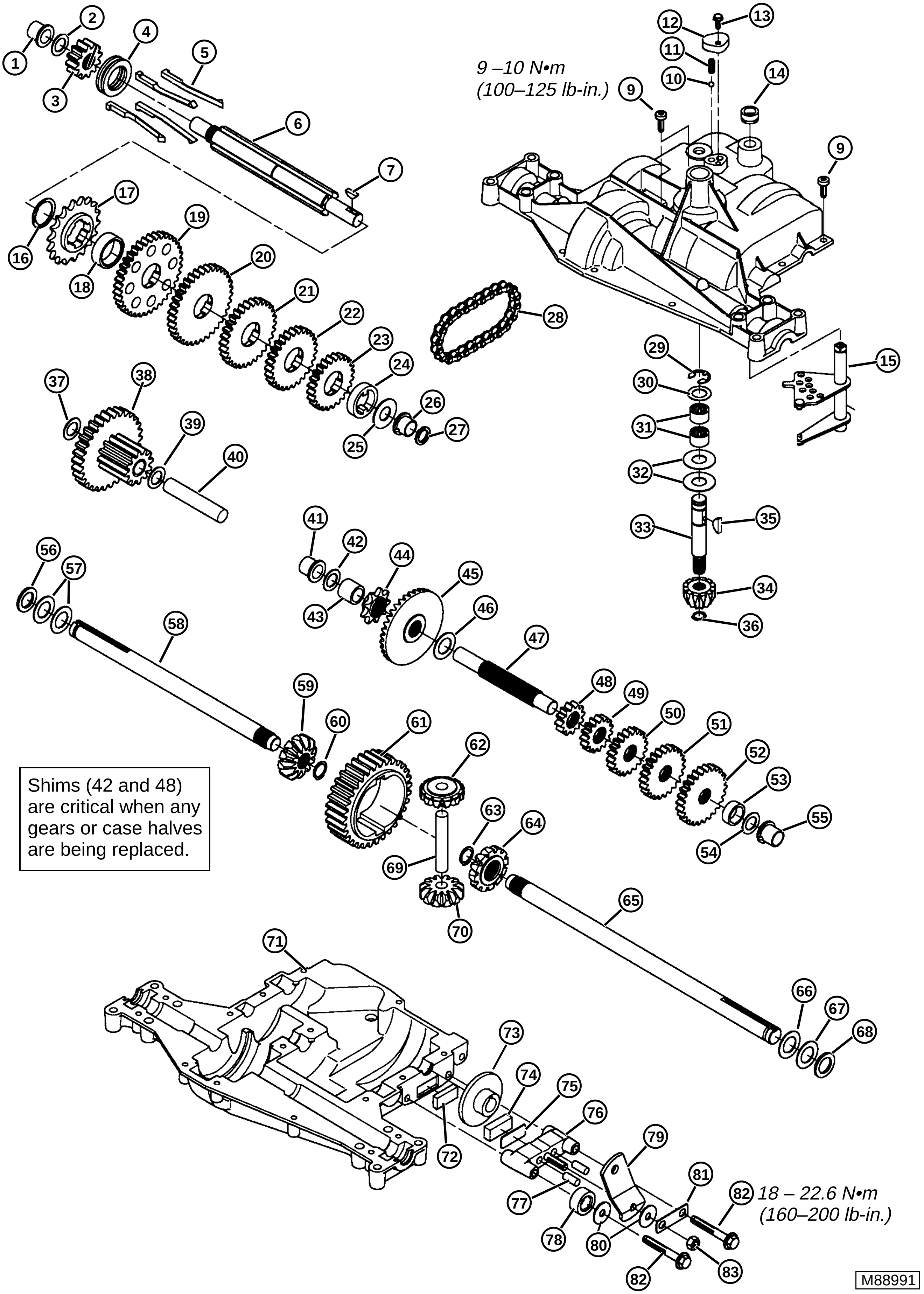
18 – 22.6 N•m (160–200 lb-in.)

18 – 22.6 N•m (160–200 lb-in.)

Shims (42 and 48) are critical when any gears or case halves are being replaced.

TRANSAXLE—DANA 5-SPEED
STX38 (SN 301383—)

1. Flange bearing
2. Shim
3. Spur gear (12 teeth)
4. Shift collar
5. Shift key (4 used)
6. Intermediate shifter/brake shaft
7. Woodruff
8. Upper case housing
9. Screw (16 used)
10. Detent ball (2 used)
11. Detent spring (2 used)
12. Detent cover
13. Detent cover screw
14. V-ring
15. Shifter fork
16. Retaining ring
17. Drive chain large sprocket/reverse gear (18 teeth)
18. Spacer
19. Intermediate shaft 1st gear (37 teeth)
20. Intermediate shaft 2nd gear (35 teeth)
21. Intermediate shaft 1st gear (30 teeth)
22. Intermediate shaft 1st gear (27 teeth)
23. Intermediate shaft 1st gear (24 teeth)
24. Spacer with internal keys
25. Washer
26. Flange bearing
27. Lip seal (open lip to inside)
28. Drive chain (24 pitches)
29. Retaining ring
30. Shim
31. Needle bearing (2 used)
32. Washer (2 used)
33. Input shaft
34. Bevel pinion gear (12 teeth)
35. Woodruff key
36. Retaining ring
37. Washer
38. Idler gear (12 & 30 teeth)
39. Shim
40. Idler shaft
41. Flange bearing
42. Washer
43. Spacer
44. Drive chain drive sprocket (9 teeth)
45. Drive shaft bevel gear (36 teeth)
46. Shim
47. Drive shaft
48. Drive shaft 1st gear (12 teeth)
49. Drive shaft 2nd gear (15 teeth)
50. Drive shaft 3rd gear (20 teeth)
51. Drive shaft 4th gear (23 teeth)
52. Drive shaft 5th gear (26 teeth)
53. Spacer
54. Washer
55. Flange bearing
56. Square-cut rubber ring
57. Washer (2 used)
58. Left axle shaft
59. Differential bevel gear (12 teeth)
60. Retaining ring
61. Differential ring gear (32 teeth)
62. Differential bevel gear (12 teeth)
63. Retaining ring
64. Differential bevel gear (12 teeth)
65. Right axle shaft
66. Shim
67. Shim
68. Square-cut rubber ring
69. Differential cross shaft
70. Differential bevel gear (12 teeth)
71. Lower case housing
72. Thin friction puck
73. Brake disc (rotor)
74. Thick friction puck
75. Friction puck striker plate
76. Brake jaw
77. Actuator dowel pin (2 used)
78. Spacer
79. Actuating lever
80. Washer (2 used)
81. Lever stop bracket
82. Tapping screw (2 used)
83. Lock nut

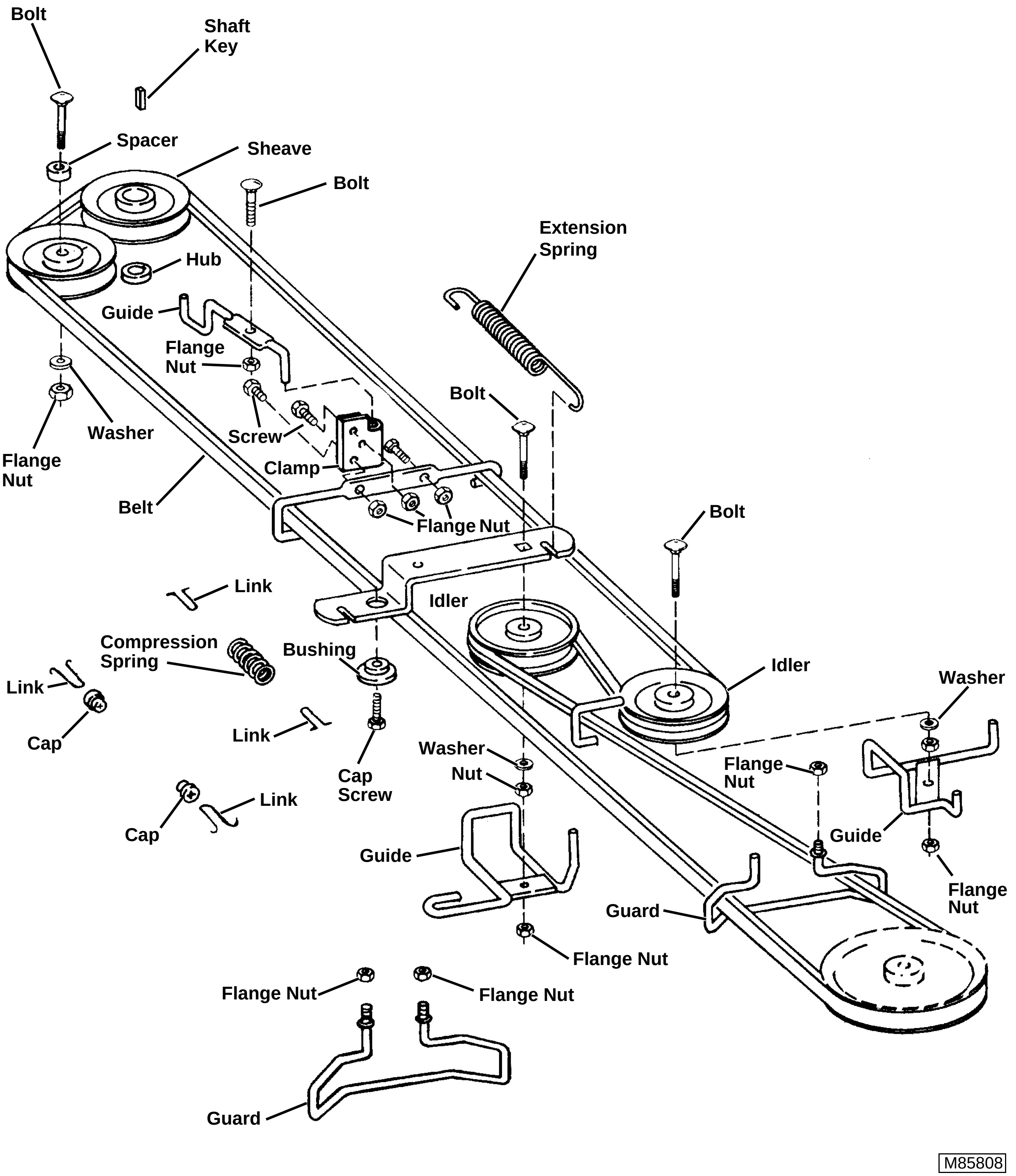


9 –10 N•m (100–125 lb-in.)

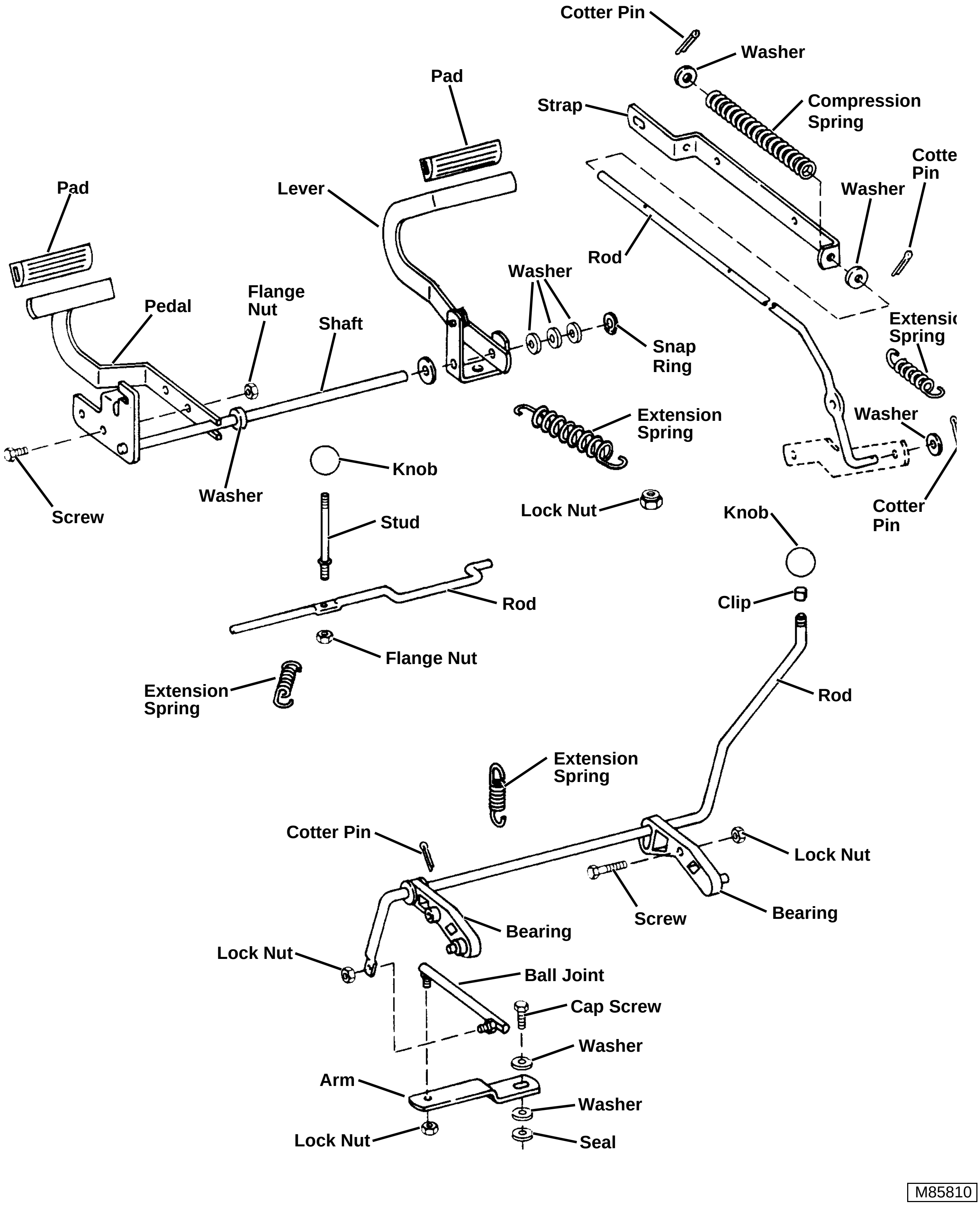
Shims (42 and 48) are critical when any gears or case halves are being replaced.

18 – 22.6 N•m (160–200 lb-in.)

TRACTION DRIVE SYSTEM STX30 & STX38 (SN —210000)



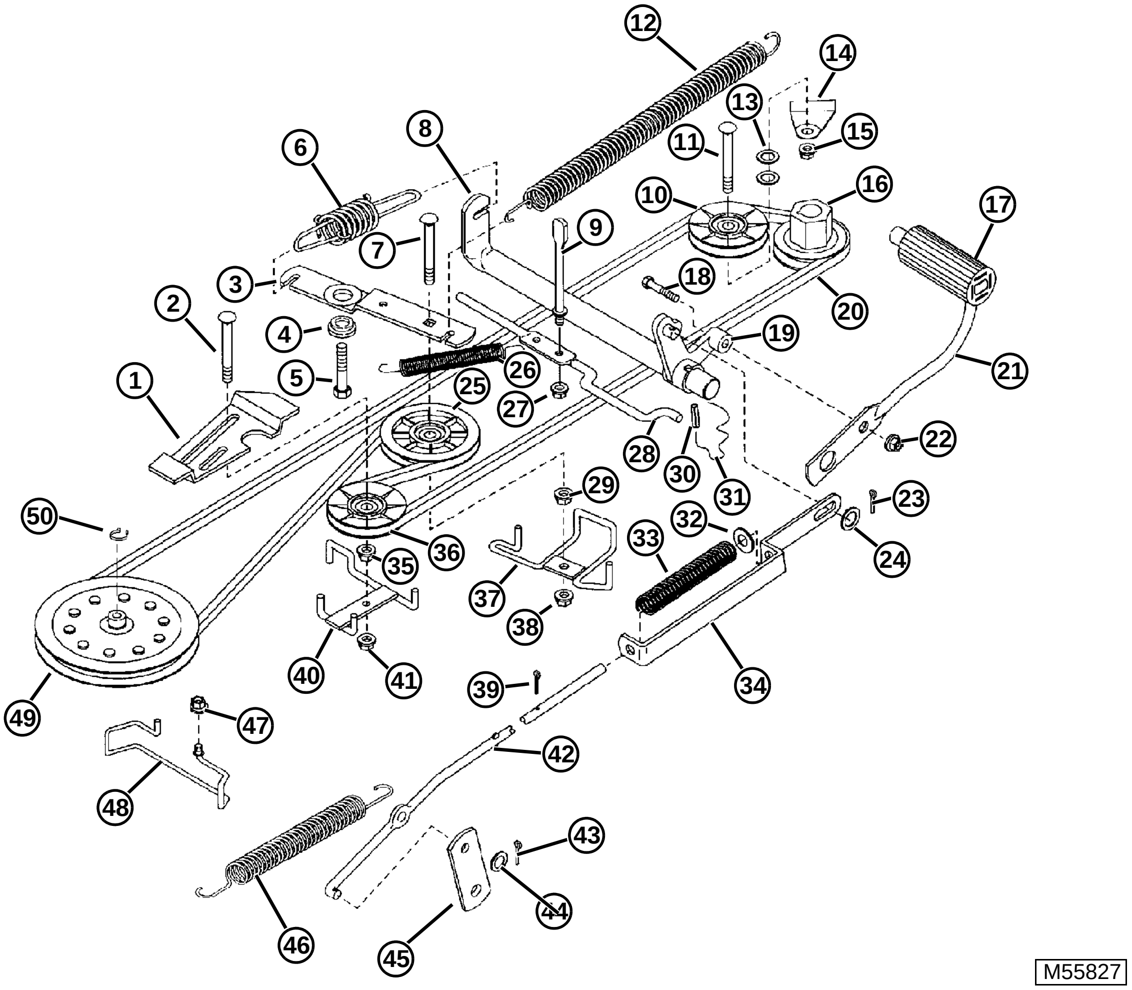
CLUTCH AND BRAKE PEDAL STX30 & STX38 (SN —210000)



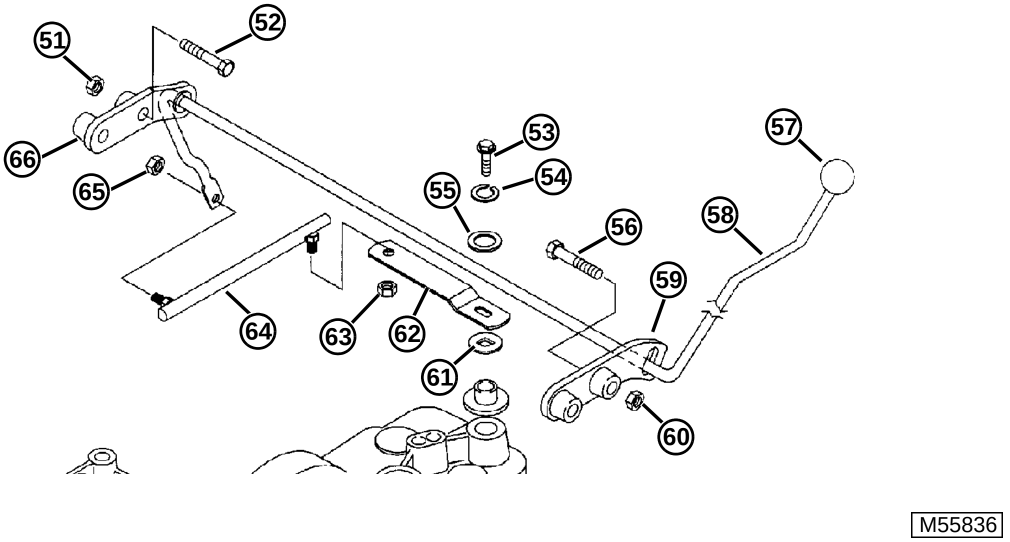
TRACTION DRIVE SYSTEM STX38 (SN 210001—) & STX46

1. Frame weldment—idler adjustment
2. Carriage bolt (M8x45)
3. Clutch bellcrank bracket
4. Bushing
5. Cap screw
6. Clutch assist spring assembly
7. Carriage bolt (M8x45)
8. Clutch cross shaft
9. Park lever
10. Idler
11. Carriage bolt (M8x50)
12. Clutch spring
13. Washer (2 used) (11/32x7/8x1/16 in.)
14. Belt guide
15. Flange nut (M8)
16. Crankshaft drive sheave
17. Foot pad
18. Cap screw (M8x35)
19. Bellcrank
20. Drive belt
21. Clutch/brake pedal
22. Flange lock nut (M8)
23. Cotter pin
24. Washer (13/32x13/16x0.065 in.)
25. Clutch sheave
26. Park locking rod tension spring
27. Flange nut (M6)
28. Park locking rod
29. Flange nut (M8)
30. Rolled pin (M4x20)
31. Safety wire
32. Washer (13/32x13/16x0.065 in.)
33. Brake rod compression spring
34. Brake compression spring strap
35. Flange nut (M8)
36. Adjustable idler
37. Belt guide
38. Flange nut (M8)
39. Cotter pin
40. Belt guide
41. Flange nut (M8)
42. Brake rod
43. Cotter pin
44. Washer (13/32x13/16x0.065 in.)
45. Brake lever
46. Brake rod return spring
47. Flange nut (M6)
48. Belt guide
49. Transaxle drive sheave
50. Snap ring
51. Lock nut (M8)
52. Cap screw (M8x30)
53. Special patch lock cap screw (1/4x0.065 in.)
54. Lock washer (1/4 in.)
55. Washer (9/32x3/4x0.120 in.)
56. Cap screw (M8x30)
57. Shift knob
58. Shift lever
59. Right shift lever mounting bracket
60. Lock nut (M8)
61. Special square hole washer
62. Shift arm
63. Lock nut (M8)
64. Universal shift link
65. Lock nut (M8)
66. Left shift lever mounting bracket

TRACTION DRIVE SYSTEM



SHIFT LINKAGE SYSTEM



THEORY OF OPERATION

CLUTCH PEDAL AND BELT TRACTION DRIVE SYSTEM OPERATION STX30 & STX38 (SN —210000)

Function:

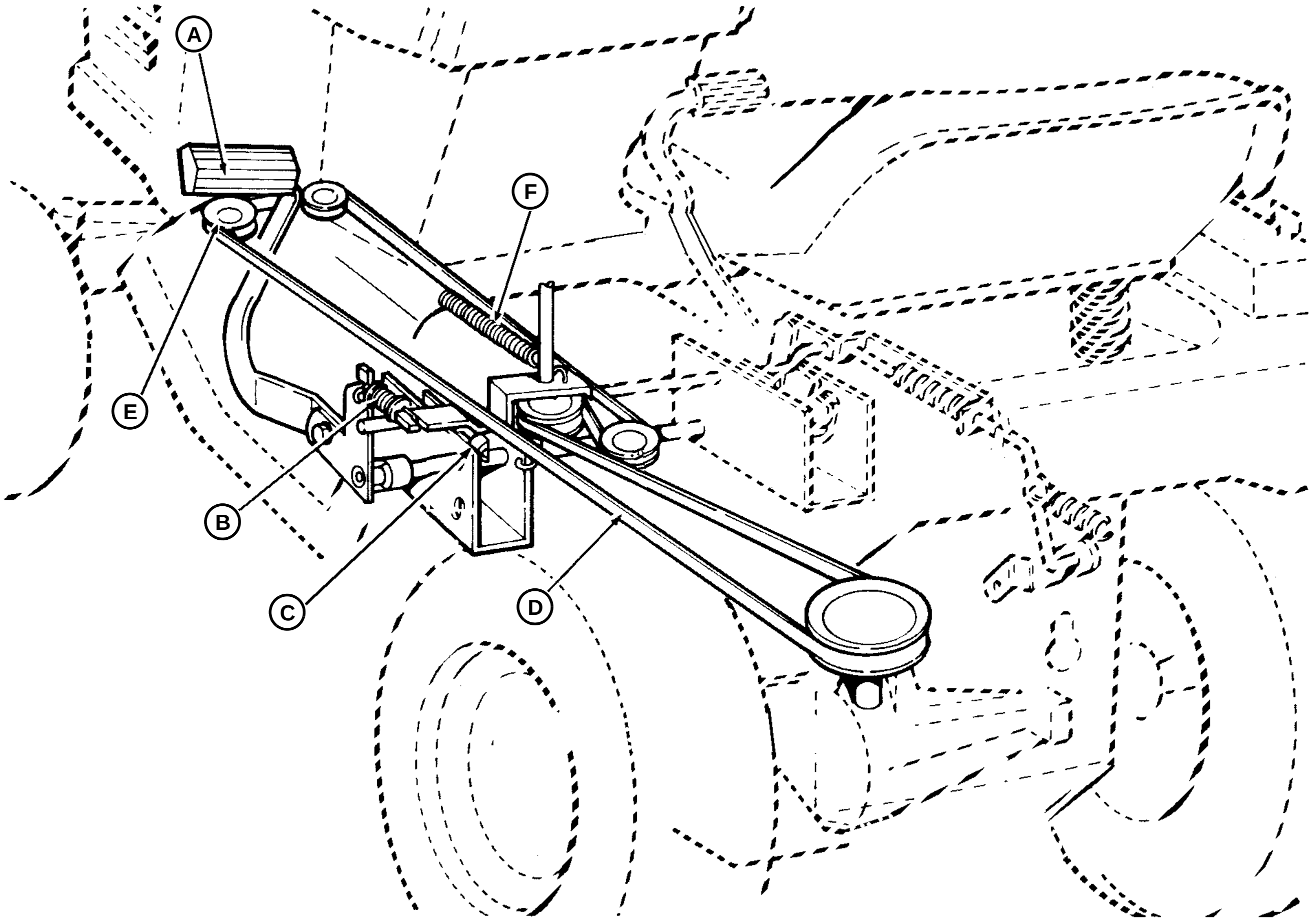
The function of this system is to transfer power from the engine to the transaxle. This system also allows the power transfer to be interrupted in order to stop in gear, change to a different gear or direction, engage power again, or shift to neutral and push the unit with the engine on or off.

Major Components:

- Engine drive sheave
- Drive belt
- Clutch pedal and shaft
- Actuating spring assembly
- Bellcrank assembly
- Transaxle drive sheave

Theory of Operation:

As the clutch pedal (A) is depressed, the clutch shaft pulls the clutch actuating spring (B) assembly forward. Initial movement of the pedal compresses the spring in the actuating assembly and once compressed transfers the movement to the bellcrank (C). As the bellcrank (C) is rotated, drive belt (D) tension is released. This allows the engine drive sheave (E) to rotate without transferring power to the belt (D) due to slack in the drive belt. As the bellcrank (C) is rotated, the belt tension spring (F) is stretched.



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CLUTCH PEDAL AND BELT TRACTION DRIVE SYSTEM OPERATION
STX38 (SN 210001—) & STX46

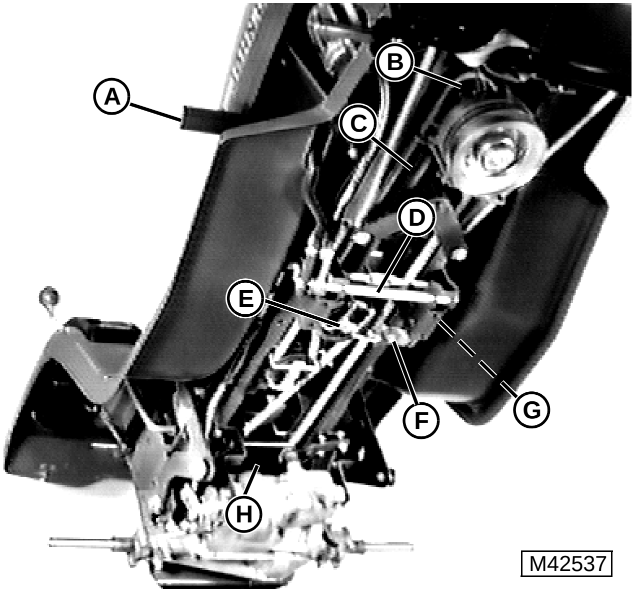
Function:

The function of this system is to transfer power from the engine to the 5-speed transaxle. This system also allows the power transfer to be interrupted in order to stop in gear, change to a different gear or direction, engage power again, or shift to neutral and push the unit with the engine on or off.

Major Components:

- Engine drive sheave
- Drive belt
- Clutch pedal and shaft
- Actuating spring assembly
- Bellcrank assembly
- Transaxle drive sheave

Theory of Operation:



With engine running and clutch engaged (clutch/brake pedal (A) released), the engine drive sheave (B) pulls the drive belt and transmits power to the transaxle drive sheave (H). As clutch/brake pedal (A) is depressed by the operator, clutch shaft (D) pulls the clutch actuating spring assembly (G) forward. Initial movement of the pedal compresses the spring in the actuating spring assembly (G) and, once compressed, pivots the bellcrank assembly (F). As the bellcrank assembly pivots, the tensioning sheave (E) moves rearward, releasing drive belt tension. This allows the engine drive sheave to rotate without transferring any power through the slackened drive belt.

As the bellcrank pivots rearward, belt tensioning spring (C) is stretched, building additional tension in the spring. As the operator begins to ease-up on the clutch/brake pedal (A), tensioning spring (C) pulls the bellcrank tensioning sheave (E) into the drive belt, causing the belt to tighten and seat in the grooves of the transaxle drive sheave (H) and the engine drive sheave (B). This interaction of components results in turning the transaxle drive sheave rapidly in a clockwise direction, transferring power from the engine to the 5-speed transaxle.

TRANSAXLE OPERATION PEERLESS MODEL 920-017, 930-004 & 930-004A STX30 (SN —135158) (SN 160759—) & STX38 (SN —139614) (SN 185587—210000)

Function:

The transaxle transmits power from the engine, through the belt traction drive system, into the transaxle gear matrix, and out the drive axles to the rear wheels. The transaxle provides a gear selection of five forward speeds and one reverse speed.

It also provides the means to interrupt the flow of power when shifted into neutral.

Major Components:

- Transaxle drive sheave
- Input shaft and pinion gear
- Beveled drive gear, drive shaft with small drive chain sprocket, drive chain, and drive gears
- Intermediate shifter/brake shaft with shifter fork, shift collar, shift keys, large drive chain sprocket/ reverse gear, drive chain, and transfer gears
- Idler shaft and combination gear
- Differential gears and axle shafts
- Wheels and tires.

Theory of Operation:

Forward:

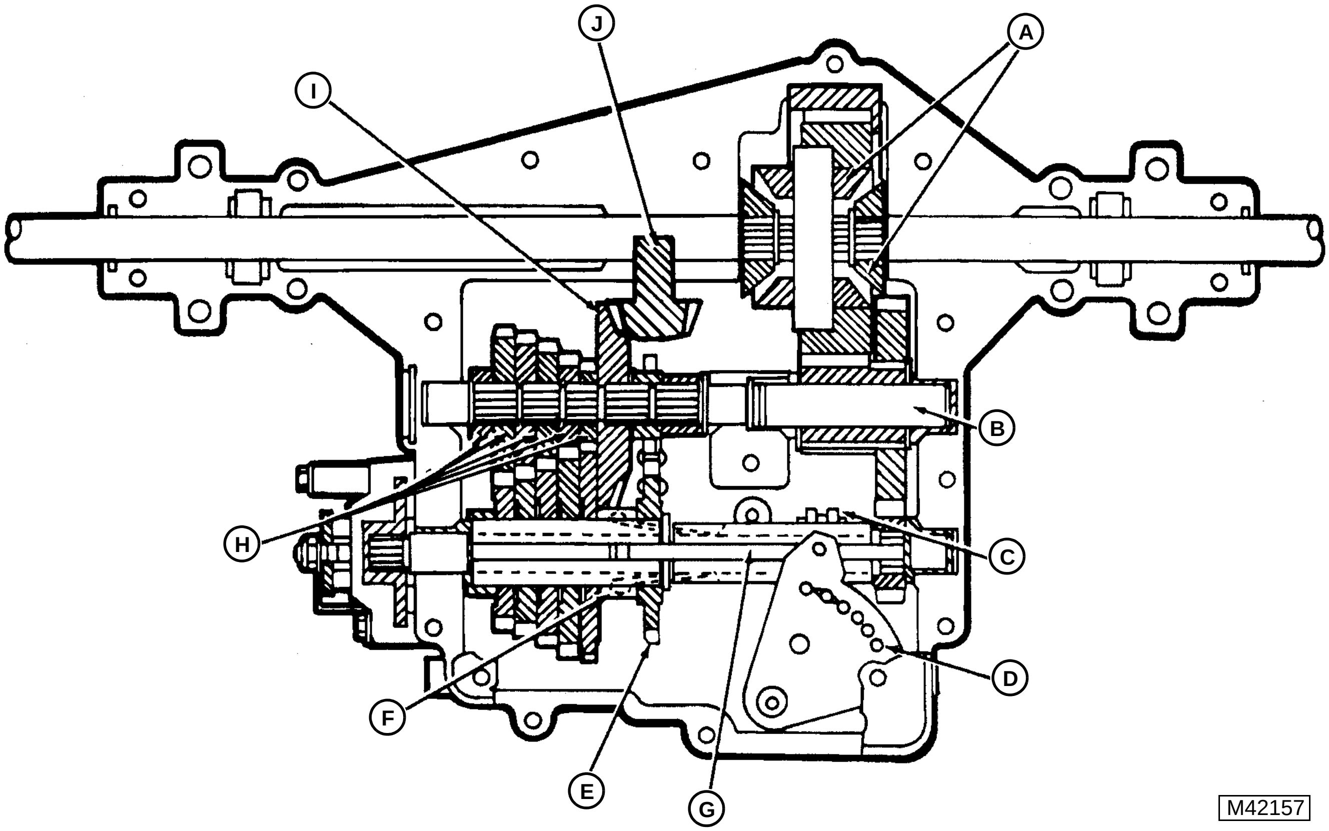
The transaxle input sheave is keyed to the input pinion (J). The input pinion (J) drives the input bevel gear (I) and forward drive gears (H). A gear is selected when the shift lever (D) moves the shift collar (C) and shift keys (F) to lock one of the driven gears to the shifter/ brake shaft (G). Power is transmitted by the gears on the right-hand end of the shifter/brake shaft (G) and counter shaft (B), back to the differential ring gear (A).

Reverse:

When reverse gear is selected, power is transmitted from the input pinion (J) and input bevel gear (I), through the reverse gear and drive chain (E). The chain, drives the shifter/brake shaft (G) in the opposite direction then the gear sets did, therefore, giving a reverse direction to the counter shaft (B) and differential (A).

Neutral:

In neutral the shift fork places the keys (F) in an area where there is no power transmitted to the shifter/brake shaft (G) and neutral is attained.



TRANSAXLE OPERATION PEERLESS MODELS 915-012A/915-012B STX30 (SN 135159—160758) & STX38 (SN 139615—185586)

Function:

The transaxle transmits power from the engine, through the belt traction drive system, into the transaxle gear matrix, and out the drive axles to the rear wheels. The transaxle provides a gear selection of five forward speeds and one reverse speed.

It also provides the means to interrupt the flow of power when shifted into neutral.

Major Components:

- Transaxle drive sheave
- Input shaft and pinion gear
- Beveled drive gear, drive shaft with small drive chain sprocket, drive chain, and drive gears
- Intermediate shifter/brake shaft with shifter fork, shift collar, shift keys, large drive chain sprocket/ reverse gear, drive chain, and transfer gears
- Idler shaft and combination gear
- Differential gears and axle shafts
- Wheels and tires.

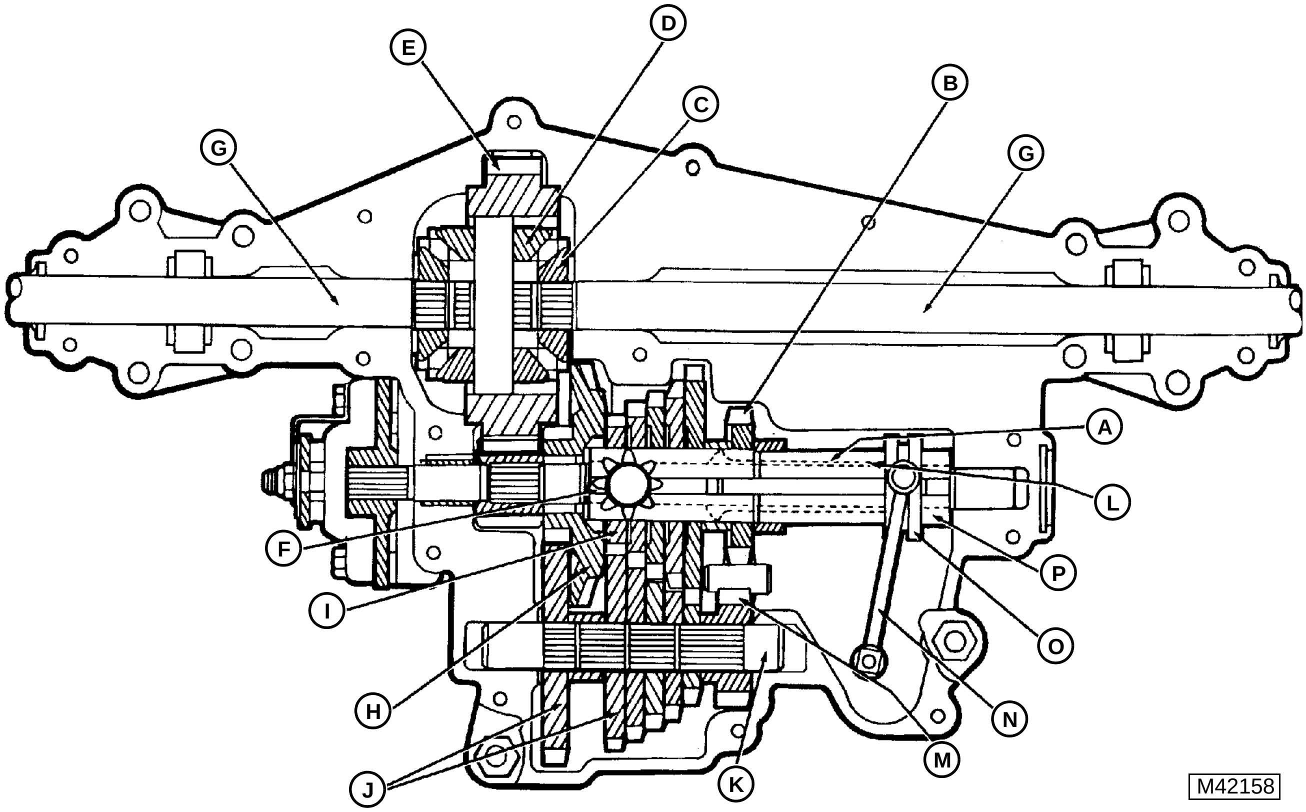
Theory of Operation:

Forward:

The transaxle input sheave is keyed to the input pinion (F). The input pinion (F) drives the bevel input gear (H). The bevel input gear (H) rotates independently of the shifter/brake shaft (A) but constantly rotates the drive shaft (K) and gears (J). When a forward gear is selected, the shift fork (N) moves the shift spool (O) and shift fingers (L) in alignment with one of the driven gears (I). The shift fingers (L) lock the selected driven gear (J) to the driven shaft (P). Power is then transmitted to the differential gear (E) and through the spider gear (D) and axle gear (C) to the axles (G).

Reverse:

When reverse gear (B) is selected, power is transmitted from the drive gears (J) and drive shaft (K), through the reverse idler (M). The reverse idler (M) changes the direction of rotation between the drive gears (J) and the reverse gear (B), rotating the shifter/ brake shaft (A) in the opposite direction.



TRANSAXLE OPERATION STX38 (SN 210001—) & STX46

Function:

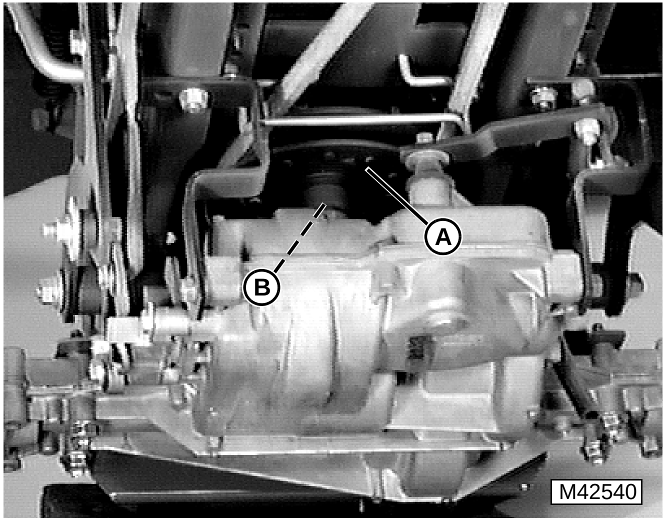
The transaxle transmits power from the engine, through the belt traction drive system, into the transaxle gear matrix, and out the drive axles to the rear wheels. The transaxle provides a gear selection of five forward speeds and one reverse speed.

It also provides the means to interrupt the flow of power when shifted into neutral.

Major Components:

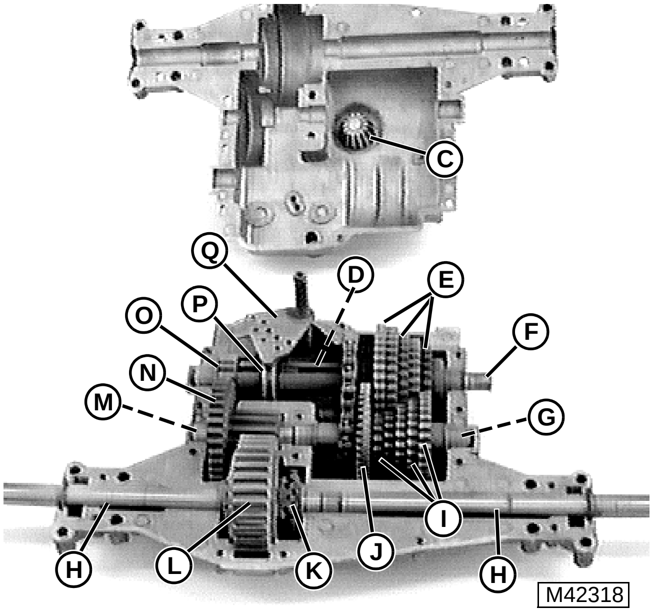
- Transaxle drive sheave
- Input shaft and pinion gear
- Beveled drive gear, drive shaft with small drive chain sprocket, drive chain, and drive gears
- Intermediate shifter/brake shaft with shifter fork, shift collar, shift keys, large drive chain sprocket/ reverse gear, drive chain, and transfer gears
- Idler shaft and combination gear
- Differential gears and axle shafts
- Wheels and tires

Theory of Operation:



Forward:

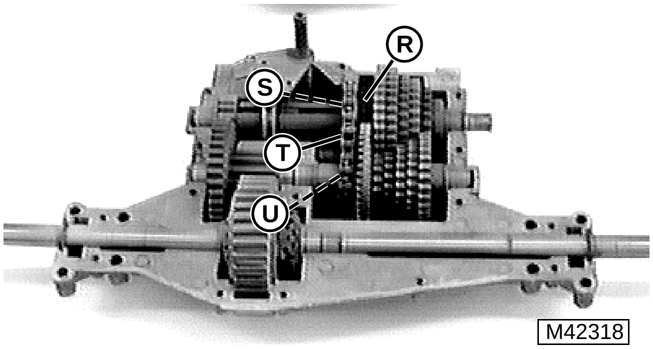
With engine running and clutch engaged, the transaxle input sheave (A) turns rapidly in a clockwise direction. The sheave is retained by a snap-ring and keyed to the input shaft (B).



The input pinion gear (C), which is splined to the input shaft and retained by a snap ring, drives the beveled drive gear (J). The beveled drive gear is splined to the drive shaft (G), as are the five forward drive gears (**I**).

A forward gear is selected when the operator moves the shift lever. The shift linkage moves the shifter fork (Q), shift collar (P), and shift keys (D) into one of the selected five transfer gears (E). The selected gear is now keyed to the intermediate shifter/brake shaft (F). Power is transferred by the selected gear (E) on the right side of the shaft to the left-side, splined spur gear (O).

The spur gear (O) drives the combination gear (N), splined to the idler shaft (M), which transfers power into the differential ring gear (L). Power is transferred by the cross shaft and bevel gears (K) to both drive axles (H) out to the wheels and tires. The keyed drive wheels are retained by a e-ring.



Reverse:

As in forward—likewise in reverse, with engine running and clutch engaged, the transaxle input sheave turns rapidly in a clockwise direction.

Power is transferred through the belt drive sheave into the input shaft pinion gear (C). The bevel drive gear (J) of the splined drive shaft (G) then carries the power through the splined small drive chain sprocket (U), the drive chain (T), and into the large drive chain sprocket (S) of the intermediate shifter/brake shaft (F).

When the operator shifts the shift lever into reverse, the shifter fork (Q), shift collar (P), and shift keys (D) become keyed to the large drive chain sprocket (S), which turns in the opposite direction as the free-wheeling transfer gears (E). Because the large drive chain sprocket (S) has been engaged by the shift keys (D), the shaft (F) turns in the reverse direction and transfers power through the left side spur gear (O) into the idler shaft combination gear (N), which also turn in the opposite direction as they did in forward.

Power is then transferred into the differential and out the drive axles to the drive wheels and tires, also in this reverse direction.

Neutral:

When the operator moves the shift lever into neutral position, the shifter fork (Q) places the shift keys (D) under the free-floating spacer (R), allowing no power to be transmitted into the intermediate shifter/brake shaft (F), which also allows neutral to be maintained with clutch pedal released and engine running.

BRAKE SYSTEM COMPONENT LOCATION AND OPERATION

IMPORTANT: Early Model STX30 & STX38 (SN —210000) brake linkage differs slightly. Theory of Operation remains the same.

Function:

The brake system allows the operator to slow down, stop, or lock the tractor into park position.

Major Components:

- Clutch/Brake Pedal
- Clutch Cross Shaft and Bellcrank
- Clutch Compression Spring Assembly
- Clutch Bellcrank and Tensioning Idler Assembly
- Adjustable Idler Assembly
- Transaxle Drive (Input) Sheave
- Brake Rod Assembly
- Transaxle Brake Assembly
- Park Brake Lever and Locking Rod Assembly

Theory of Operation:

NOTE: Clutch/brake pedal has approximately 127 mm (5 in.) of travel.

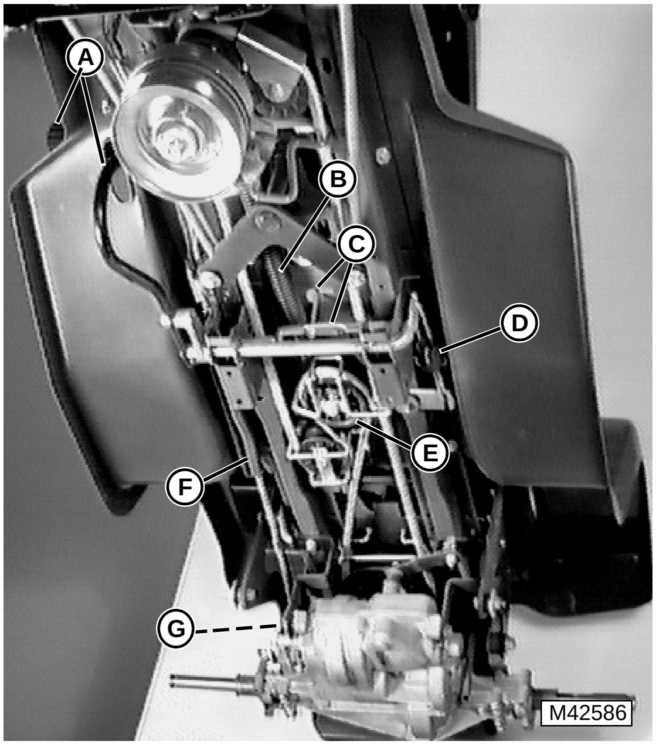
The first segment of clutch/brake pedal travel (N) is taking-up freeplay in the linkage and start of compression of clutch bellcrank actuating spring assembly (D).

The next segment of travel (O) is fully compressing the clutch bellcrank actuating spring assembly (D) and pulling the traction drive clutch bellcrank and idler assembly (E) fully rearward, overcoming the belt tensioning spring (B) and fully disengaging the traction drive system. As the pedal is released, belt tensioning spring (B) pulls clutch bellcrank and idler assembly (E) forward into the belt, tensioning the belt and fully engaging the traction drive system.

There is a small segment of pedal travel (P) that briefly allows the tractor to free-wheel so the operator can shift-on-the-go before any brake engagement starts to occur. However, this segment can be adjusted to be more aggressive, causing more friction (overlapping) between clutch and brake functions if desired, especially in the higher gears.

The last segment of travel (Q) is engaging the brake system and manually locking of the park brake linkage (C). The brake lever (G), with the bottom cam surface contour (I), pushes the two dowel pins (J) against the striker plate (K). The striker plate forces the thicker, outer friction puck (L) against the brake disc (H). The two friction pucks (L and M) become compressed against both sides of the brake disc (H). The brake disc is keyed to the end of the intermediate shifter/brake shaft (not shown). When the compression force of the friction pucks is great enough to stop the brake disc rotation, the transaxle and wheels stop turning. This works in conjunction with the clutching system.

With the clutch/brake pedal (A) fully depressed and the traction drive system disengaged (fully clutched), the park brake lever assembly (C) can be engaged, locking the clutch/brake pedal linkage and the brake disc in park position.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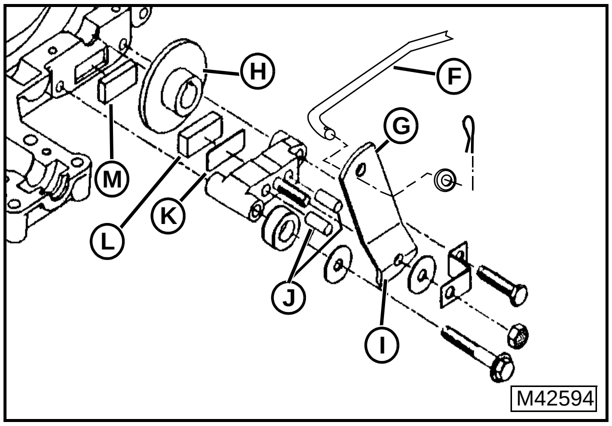
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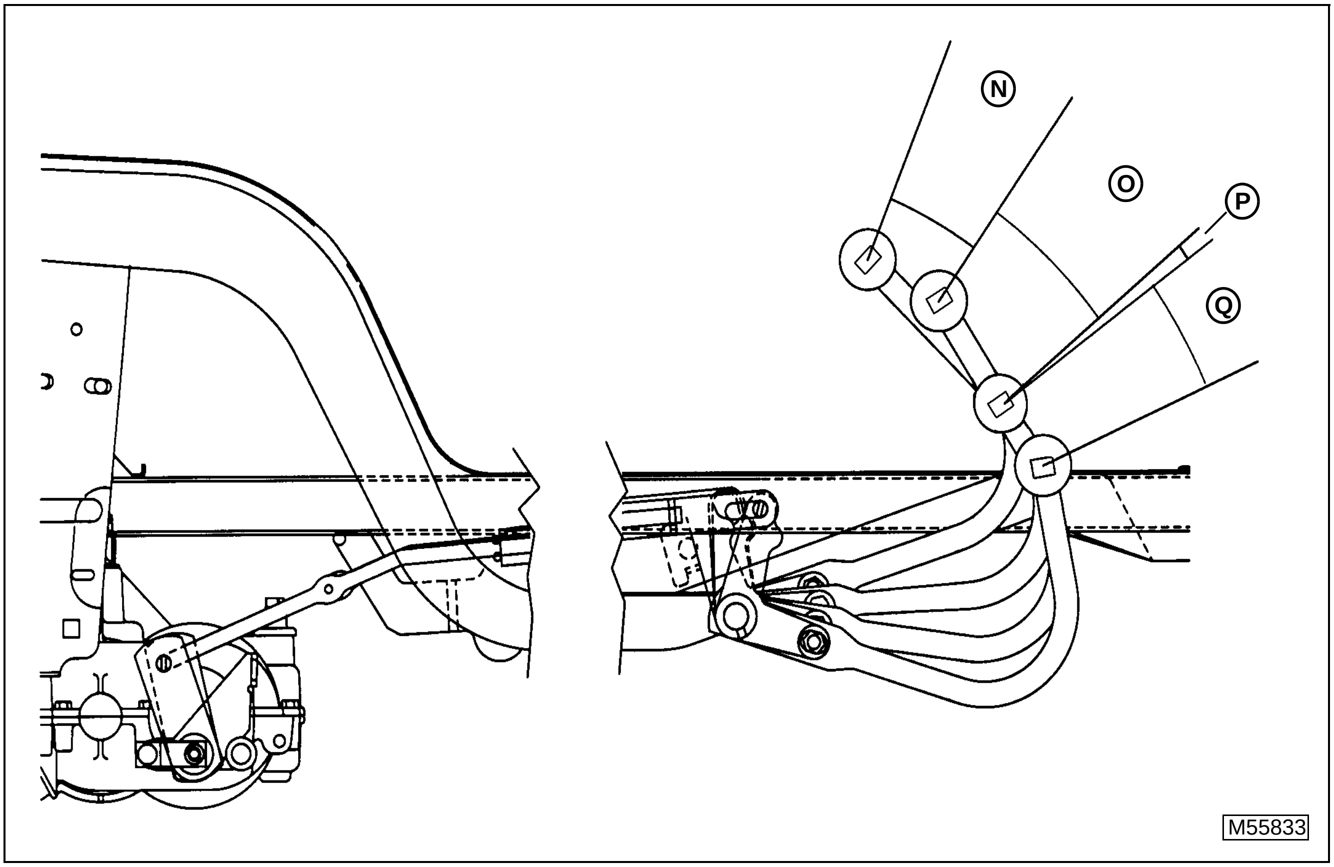
N
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M55833

TROUBLESHOOTING

Problem or Symptom / Check or Solution	Belt jumping off or slapping	Lack of drive in one or both directions	Loses power under load, belt slips, or erratic drive	Jerky or aggressive engagement	Cannot get all forward gears	Cannot get reverse gear	Jumps out of gear or must hold into gear	Shifts hard	Noisy operation	Leaking grease	Brakes will not stop tractor	Park brake will not hold
Belt sheaves, idlers, and guides loose, out of adjustment, worn, or damaged—tighten, replace, or adjust properly	●	●	●	●					●			
Belt worn, frayed, glazed, or stretched—replace belt	●	●	●	●					●			
Clutch/brake pedal linkage out of adjustment—adjust properly	●	●	●	●			●	●			●	●
Clutch/brake components worn, bent, or broken—replace and adjust properly	●	●	●	●	●	●	●	●	●		●	●
Shift lever and linkage bent, worn, out of adjustment, or broken—replace or adjust properly					●	●	●	●				
Input sheave, input shaft, and axle keys or keyways worn or damaged—replace		●	●	●					●		●	●
Internal components worn, stripped, or broken—replace necessary components	●	●	●	●	●	●	●	●	●		●	●
Transaxle case halves worn or broken—replace halves	●	●	●	●	●	●		●	●	●		
Incorrect type or volume of lubricant used—replace with correct type and volume	●	●	●	●	●	●	●	●	●	●		
Intermediate shifter/brake shaft or axle seals worn or damaged—replace seals		●	●		●	●	●	●	●	●		
Transaxle cap screws loose or case holes stripped—tighten or replace case half.		●	●		●	●	●	●	●	●		
Poor application of transaxle case halves sealant—replace sealant properly										●		
Incorrect type sealant—replace with proper sealant										●		

NOTES

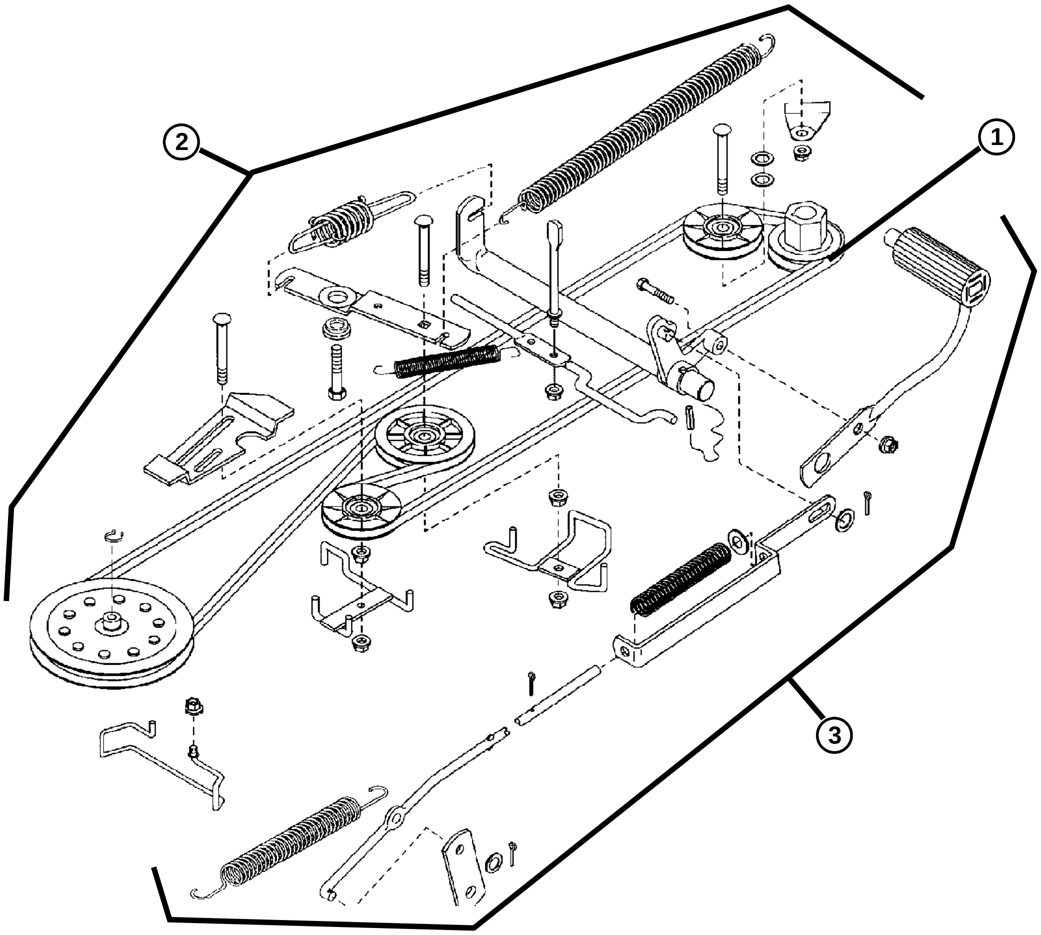
DIAGNOSIS

Test Conditions:

- Tractor on level surface
- Engine OFF
- Front wheels blocked
- Rear wheels raised off surface with axle housings on jack stands

Test/Check Point	Normal	If Not Normal
1. Drive belt.	Belt in good condition, not glazed, split, unraveled, or stretched. Minimum width 11 mm (0.43 in.).	Replace drive belt.
2. Sheaves, idlers, and belt guides.	Sheaves, idlers and guides in good condition. Guides installed, properly adjusted and tight.	Replace any loose, worn, or damaged components. Adjust and tighten.
3. Clutch/brake pedal linkage.	Clutch/brake pedal linkage adjusted properly.	Adjust clutch/brake pedal linkage. Repair or replace clutch/brake pedal components.
	Clutch spring measurement adjusted properly.	Adjust rear belt idler for correct clutch spring measurement.
4. Shift linkage.	Shift linkage adjusted properly, shifts smoothly, and obtains all gears.	Adjust linkage. Repair or replace as needed.
5. Brake assembly.	Disk and pads not worn or binding.	Repair or replace as needed.
6. Internal transaxle components.	Shifts smoothly, and obtains all gears.	Repair or replace components as needed.
7. Exterior of transaxle housing.	No cracks, leaks, or loose hardware.	Tighten hardware. Repair or replace as needed.
8. Tires, wheels and axles.	Tire pressure equal.	Adjust air pressure.
	Driving tires have same radii.	Match tires for same radii.
	Wheels not bent or out of round.	Replace wheels.
	Keys, keyways and E-rings in good shape and seated correctly.	Repair or replace as needed.

Continued on page 5-32



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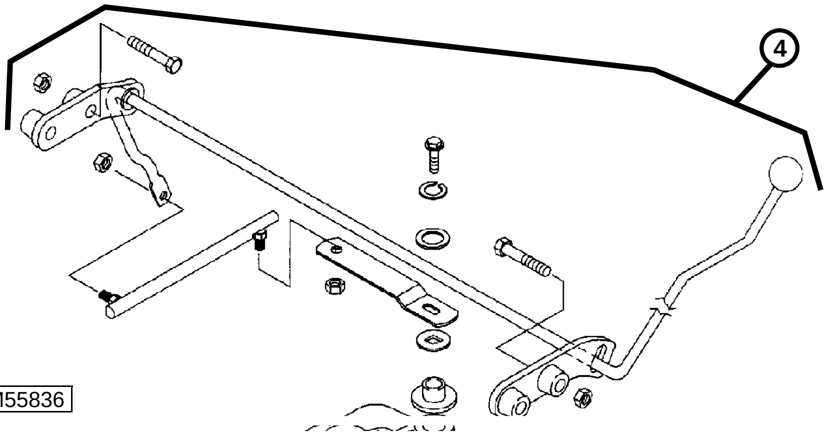

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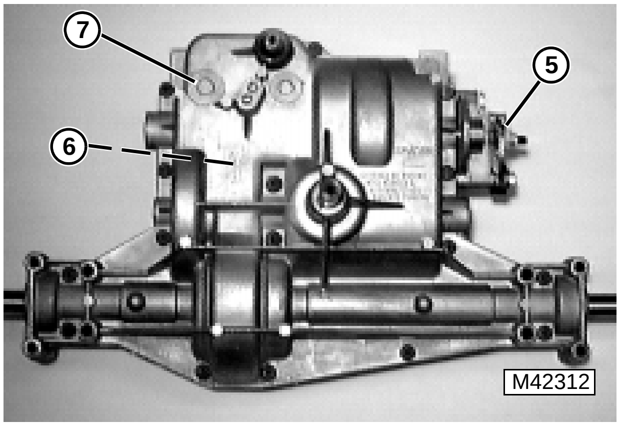

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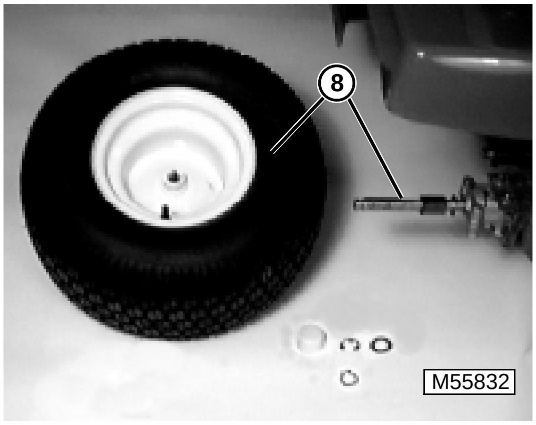
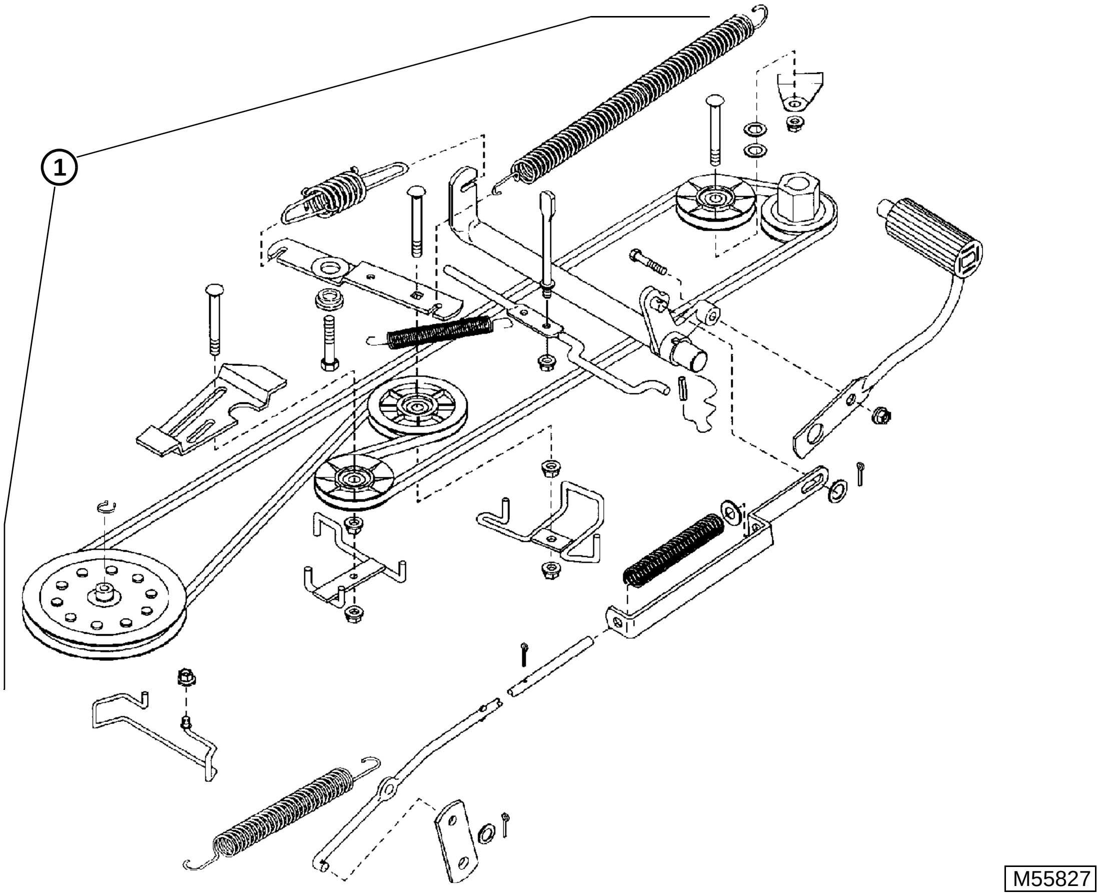


M55832

Test Conditions:

- Tractor operating in test area
- Engine at operating temperature
- Tests run at engine slow idle and fast idle
- Transaxle run through all speeds in both directions

Test/Check Point	Normal	If Not Normal
1. Running in test area.	Engine running smoothly through out throttle range.	Adjust or tune engine.
	Belt not squealing or vibrating.	Check belt condition.
		Check adjustment and condition of idlers and guides.
		Replace components as needed.
	Shifting is smooth and all gears obtained.	Check clutch/brake linkage adjustment and condition. Adjust, repair or replace as needed.
		Check transaxle internal components. Repair or replace as needed.
		Check brake components. Repair or replace as needed.
	Constant speed is maintained.	Check belt condition.
		Check adjustment and condition of idlers and guides.
		Check clutch/brake linkage adjustment and condition.
		Check transaxle internal components.
		Check brake components.
		Check axles, wheels and tires.
		Replace components as needed.
	Brakes stop tractor and hold on 17° slope.	Check brake linkage and components. Repair or replace as needed.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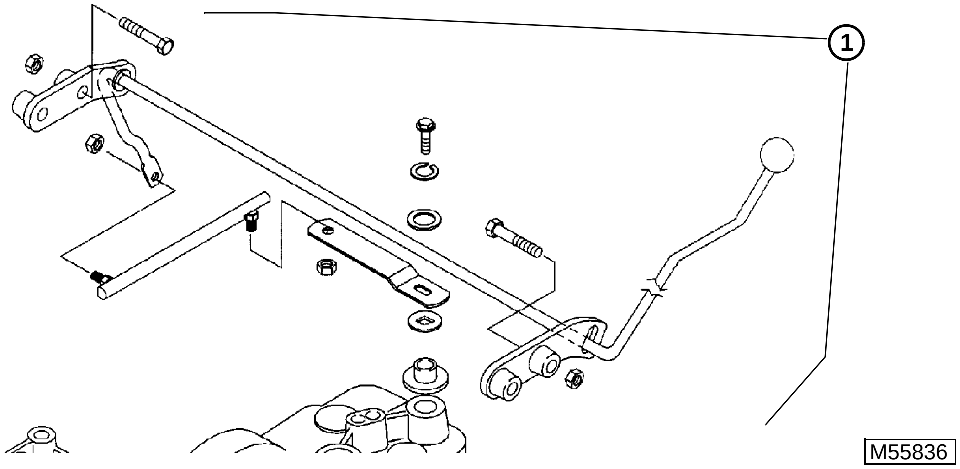
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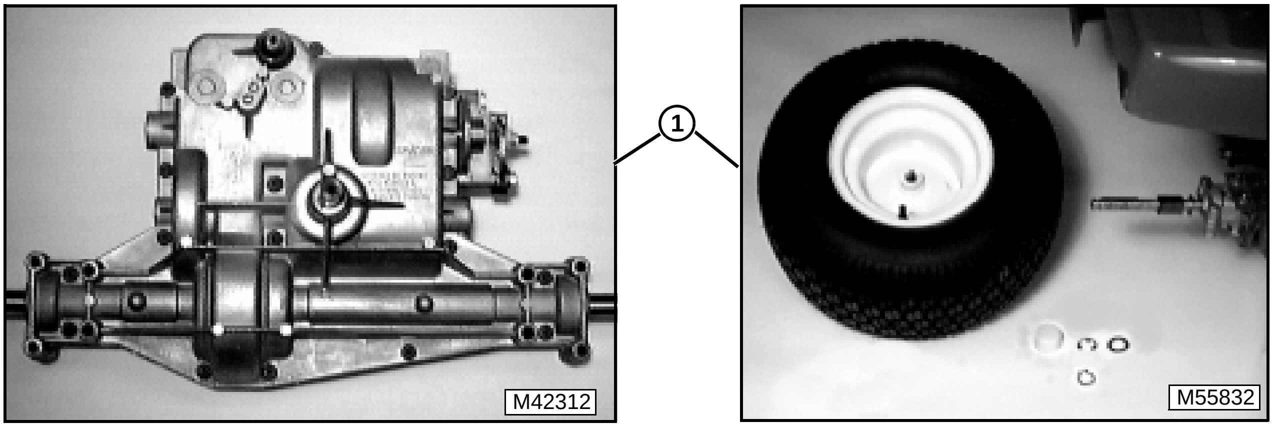
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TESTS AND ADJUSTMENTS

CLUTCH/BRAKE PEDAL LINKAGE AND TRACTION DRIVE SYSTEM

Reason:

To ensure clutch/brake pedal linkage and traction drive system maintains traction in all three lower gears up a 17° slope. Also, to ensure it disengages traction drive belt, engages brake to slow down or stop tractor within a specified distance, and holds tractor stationary in PARK position on a 17° slope or less.

Procedure:

NOTE: This is a four part test and adjustment procedure:

- Test drive on 17° slope,
- Brake spring adjustment,
- Clutch spring adjustment,
- Repeat test drive on 17° slope.

Test Drive—

CAUTION

DO NOT engage clutch/brake pedal too aggressively or tractor may tip over backwards while performing the test drive on a 17° slope.

M42597

1. Test drive tractor to see if traction drive system pulls tractor up a 17° slope in all three lower gears.
2. Look for a steady pull in all three lower gears up the slope.
3. If traction test fails in any or all of the three lower gears, the belt tension must be adjusted.

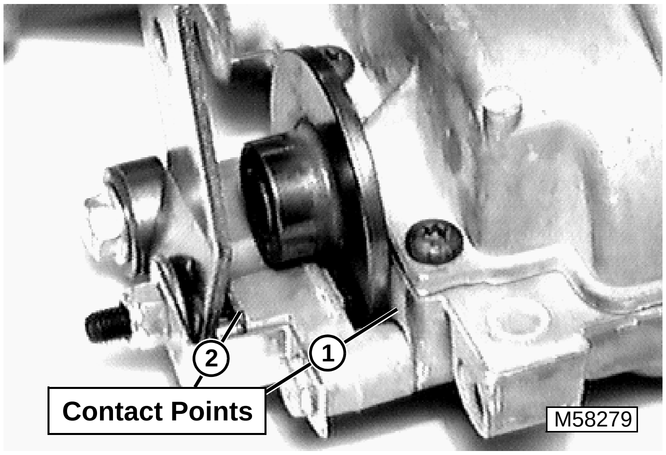
M42598

4. Drive or push tractor onto a 17° slope and lock clutch/brake pedal in PARK position.
5. **Park brake must hold tractor stationary on slope and tractor must not creep downward once park brake is set.**
6. Drive tractor on dry pavement in a safe, open, and level area at fast idle in high gear. Apply a “panic stop” force (no more than 50 pounds of force) to brake pedal—**tractor must stop within 0.9—1.5 M (3—5 ft) and both wheels should lock-up, leaving skid marks on pavement**.
7. Repeat Steps 4—6 for reverse.
8. If any test fails, the clutch and brake linkages must be adjusted or components replaced.

IMPORTANT: Anytime the brake or clutch spring need to be adjusted, both must be examined to ensure desired results will be obtained.

BRAKE SPRING ADJUSTMENT

IMPORTANT: Anytime the brake or clutch spring needs to be adjusted, both must be examined to ensure desired results will be obtained.



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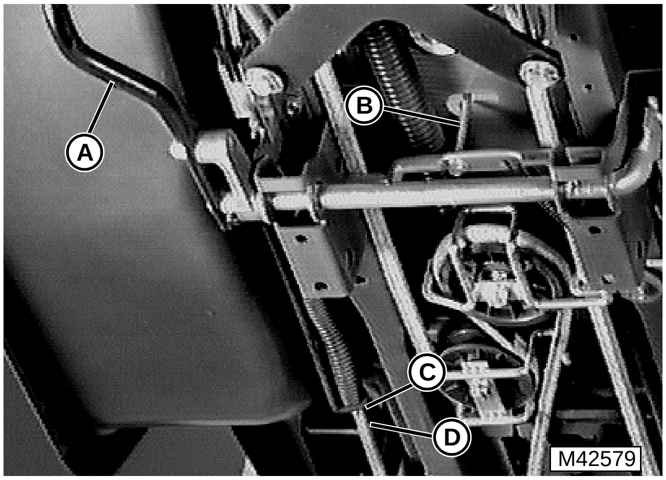
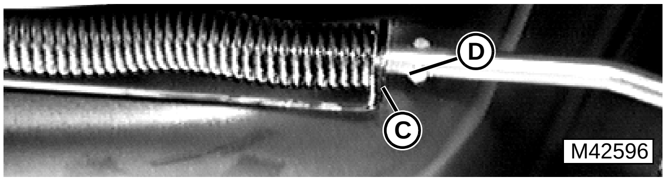
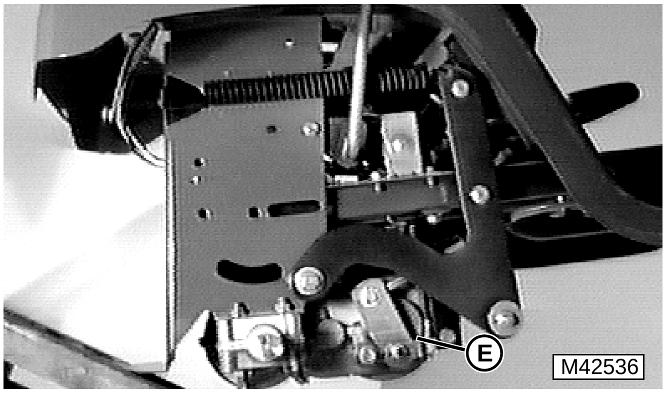
1. First check for brake disc contacting the case (1) and/or brake lever contacting its mounting bracket (2), top or bottom. Clearance between friction pucks and disc should be 0.254—0.508 mm (0.010—0.020 in.). If necessary, replace friction pucks and disc before making any adjustments.







NOTE: These adjustment procedures can be performed with tractor on the floor; however, you may want to safely raise the tractor for easier access. If you do, remove the battery to avoid spilling any electrolyte solution.

2. Remove the mower deck.
3. Depress clutch/brake pedal (A) and lock lever (B) into PARK position from operator's station.
4. Measure distance between end of compression spring bracket (C) and front edge of brake rod stop tabs (D):

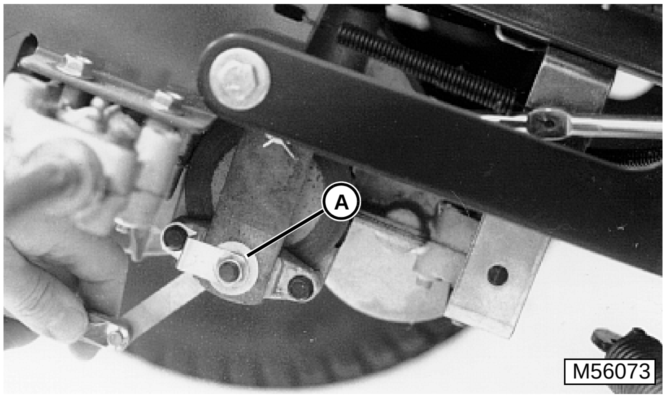
If distance is less than 2 mm (0.08 in.)—

5. Unlock park brake, release pedal, and gradually tighten lock nut (E) until freeplay in brake arm assembly is removed.
6. Depress pedal and lock park brake.
7. Remeasure distance between end of compression spring bracket (C) and front edge of brake rod stop tabs (D), it should read 7.5—8 mm (0.30—0.32 in.).
8. Once above measurement is obtained, recycle clutch/brake pedal again.
9. Remeasure distance, it should be the same. This brake setting should hold the tractor stationary on a 17° slope.

If distance is greater than 8 mm (0.32 in.)—

10. With park brake set, gradually loosen lock nut (E) until distance of 7.5—8 mm (0.30—0.32 in.) is obtained.
11. Recycle park brake a few times and remeasure distance each time (see Step 7).

BRAKE PAD ADJUSTMENT



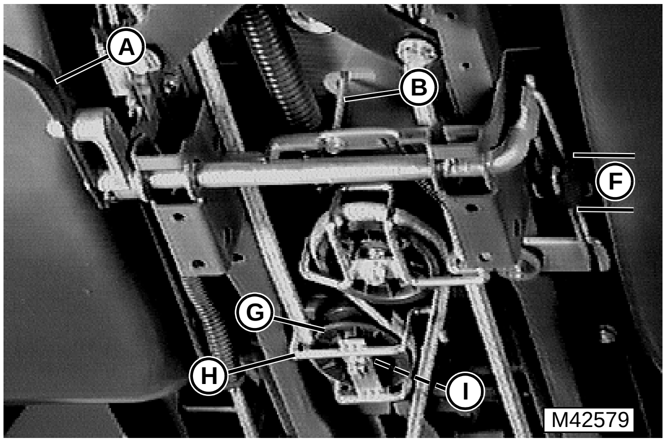
1. Check brake linkage, pads and rotor for wear, binding and dirt.
2. Insert feeler gauge between rotor and outside brake pad. Clearance between friction pucks (brake pads) and disc (rotor) should be 0.254 mm (0.010 in.).
3. Adjust nut (A) to get specified clearance.
4. Brakes should hold on a 17° slope and not drag when tractor is level and in neutral.

Specifications:

Brake Pad Clearance
. . . . . 0.254 mm (0.010 in.)

CLUTCH SPRING ADJUSTMENT

IMPORTANT: Anytime the brake or clutch spring need to be adjusted, both must be examined to ensure desired results will be obtained.



M42579

1. Unlock park brake (B) and release pedal (A).
2. Measure clutch spring length (F).

IMPORTANT: STX30 & STX38 (SN —210000) clutch spring length is 47mm (1.85 in.). STX38 & STX46 (late models) clutch spring length is 42—45 mm (1.65—1.77 in.).

3. Adjust rear idler (G) until clutch spring length meets above specification.
4. Depress pedal and lock park brake.
5. Remove belt guide (H) to access idler nut (I).
6. Adjust idler rearward slightly if measurement is less than specification. Adjust idler forward slightly if measurement is greater than specification. Tighten idler nut (I).
7. Recycle pedal in and out of park two or three times, remeasuring clutch spring length each time. Measurement must fall within specification each time. If not, continue to adjust rear idler slightly until it does.
8. Install belt guide (H). This clutch spring setting should provide proper belt tension to pull tractor up a 17° slope in all three lower gears.
9. Install battery, if removed.

Repeat Test Drive—

⚠ CAUTION

DO NOT engage clutch/brake pedal too aggressively or tractor may tip over backwards. It is recommended that you install the mower deck before performing the test drive on a 17° slope.

1. Attach mower deck to tractor—this will help stabilize the tractor.
2. If brake components were not replaced, drive tractor in a safe, open, and level area at fast idle in high gear. Apply a “panic stop” force (no more than 50 pounds of force) to brake pedal—tractor must stop at rate of 30.5 cm (12 in.) per mph.

M42597

3. Carefully test drive tractor to see if traction drive system pulls tractor up a 17° slope in all three lower gears.
4. Look for a steady pull in all three lower gears up the slope. If tractor fails traction test, inspect traction drive belt:

- if belt is excessively worn, stretched, glazed, or unraveling—replace it
- if belt is not excessively worn, make finite adjustments above or below specification to gain proper response in traction drive system. **Remember—**to **lengthen** clutch spring causes **increased** traction and aggressiveness; to **shorten** clutch spring causes **decreased** traction and aggressiveness.

M42598

5. Drive tractor onto a 17° slope and lock clutch/brake pedal in PARK position. Check that park brake holds tractor stationary on slope and that tractor does not creep downward once park brake is set.
6. If tractor fails either brake test, inspect brake assembly components, replace as necessary, and repeat all adjustment procedures and drive tests.

SHIFT LINKAGE ADJUSTMENT

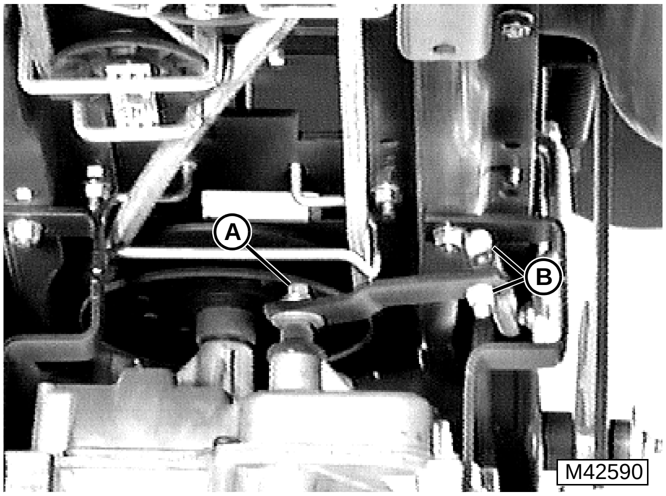
Reason:

To ensure shift lever obtains all shift positions and that neutral position does not allow transaxle to creep.

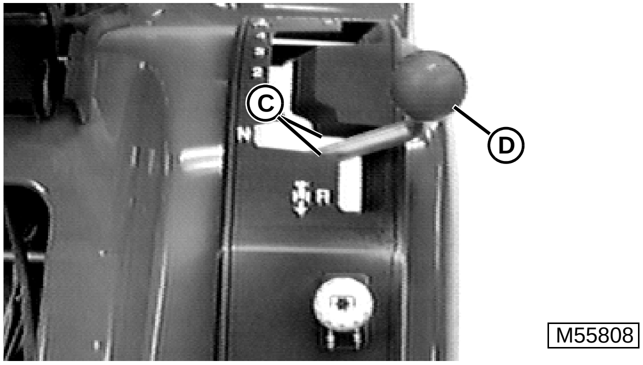
Conditions:

- Safely raise rear wheels 51 mm (2 in.) off surface and block front wheels (front and rear).
- Shift lever in neutral.
- Park brake off.

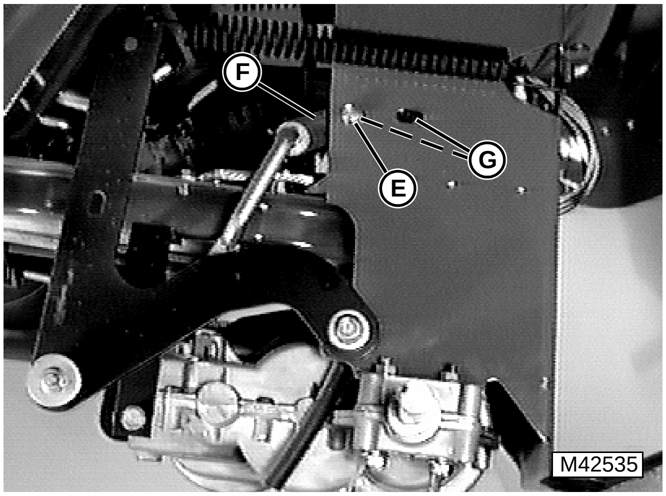
Procedure:



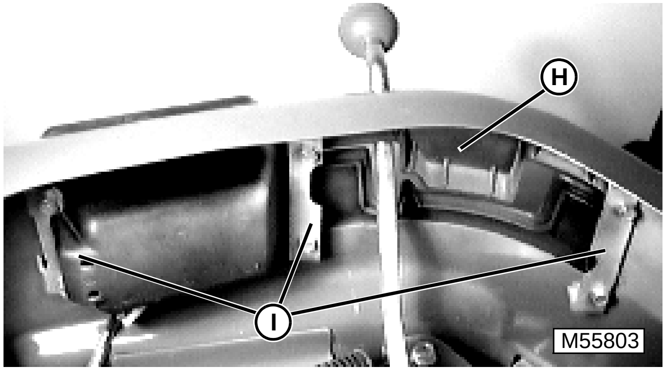
1. Check that shift linkage hardware (A and B) is in good condition and tight.



2. Start and run engine at fast idle.
3. Check that transaxle does not creep (axle rotation while shift lever is in neutral position and clutch/ brake pedal released).
4. If transaxle creeps, move shift lever (D) slightly inside neutral slot (C) of shift quadrant until creep motion stops.



5. If shift lever is moved and creep motion does not stop, turn engine off and loosen left side lock nut (E) (left wheel removed for clarity purposes only).
6. Start and run engine at fast idle while you slide left side bracket (F) forward or rearward in slots (G) until creep motion stops. Tighten nut.



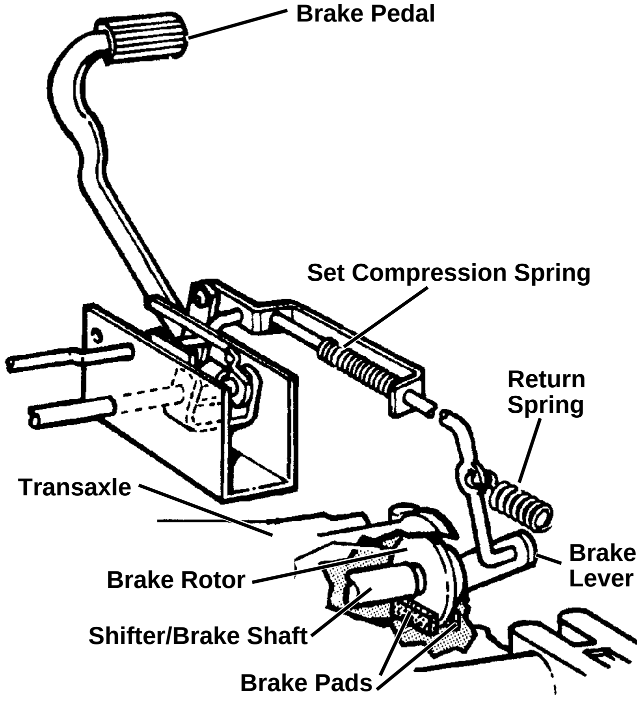
7. If left side bracket adjustment (Step #6) does not stop creep motion and shift quadrant (H) does not allow enough shift lever movement to stop creep motion, loosen three mounting brackets (I).
8. Adjust quadrant forward or rearward until transaxle does not creep with shift lever in the center of the neutral position and clutch/brake pedal released.
9. Stop engine, hold quadrant in place, and tighten three mounting brackets (I).
10. Lower tractor to surface and remove blocks.

Results:

- Test drive tractor to ensure all forward and reverse gears are obtained and that transaxle does not creep in neutral position.
- If adjustments are not satisfactory, repeat procedure until proper results are obtained.
- If adjustments are still not satisfactory, internal transaxle repair is needed.

REPAIR

BRAKES STX30 & STX38 (SN —210000) REMOVAL/ INSTALLATION



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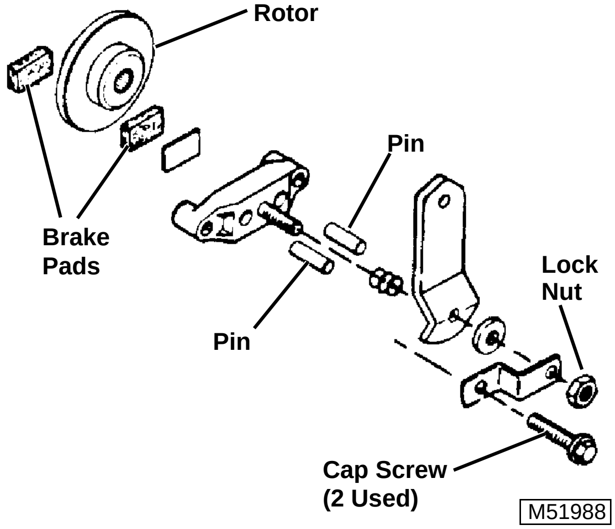
NOTE: When the brake pedal is depressed, the set compression spring puts an adequate pressure on the brake lever. The brake lever, by cam action squeezes the brake pads against the rotor. The rotor is splined to the shifter/brake shaft. If the rotor cannot rotate the shifter/brake shaft locks the differential and axles from moving, providing the braking action.

Removal

1. Remove right rear wheel.
2. Remove linkage from brake lever.



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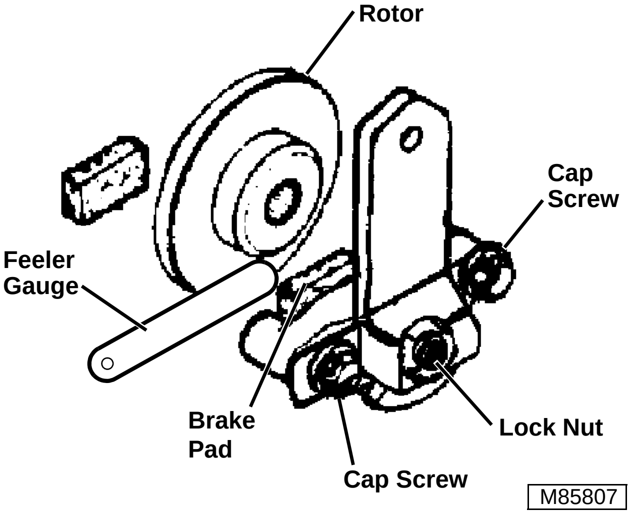
3. Remove cap screws, rotor, and brake pads.
4. Check brake linkage, pads and rotor for wear, binding and dirt.

Installation

5. Apply LUBRIPLATE® to pins.
6. Install pads.



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7. Install assembly to transaxle using cap screws.
8. Install linkage in brake lever.
9. Insert feeler gauge between rotor and outside brake pad.
10. Adjust lock nut to get 0.254—0.508 mm (0.010—0.020 in.) clearance between rotor and brake pad.
11. Install right rear wheel.

Specifications

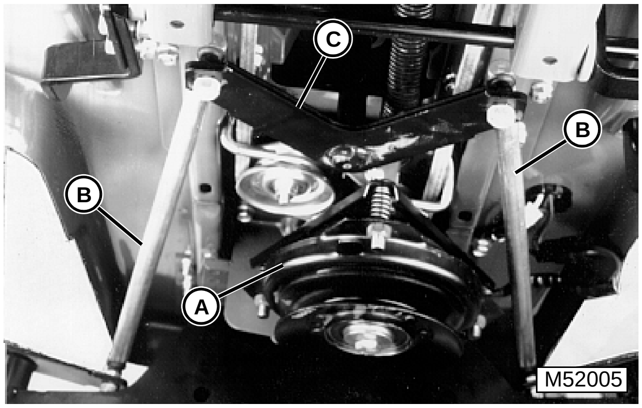
Brake Pad to Rotor Clearance
. . . . 0.254—0.508 mm (0.010—0.020 in.)

TRACTION DRIVE BELT REMOVAL/ INSPECTION/INSTALLATION— STX30 & STX38 (SN —210000)

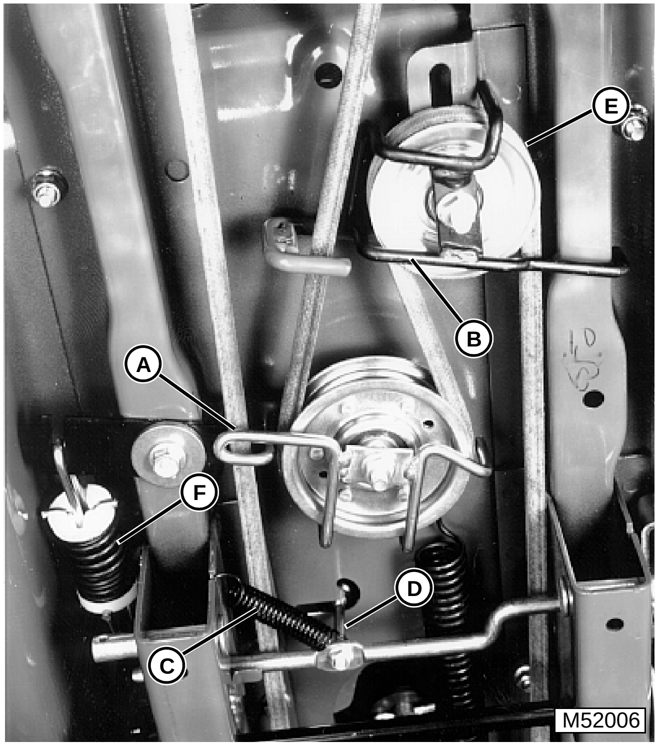
Removal

1. Remove ignition key and disconnect spark plug wire.

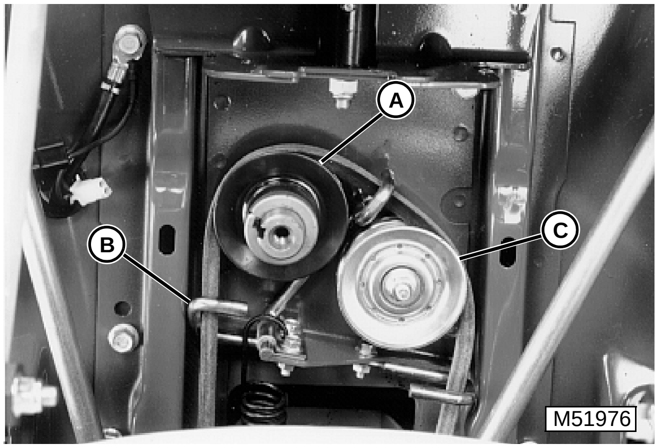
NOTE: It is not necessary to remove PTO clutch to remove drive belt on units with the spun formed drive sheave.



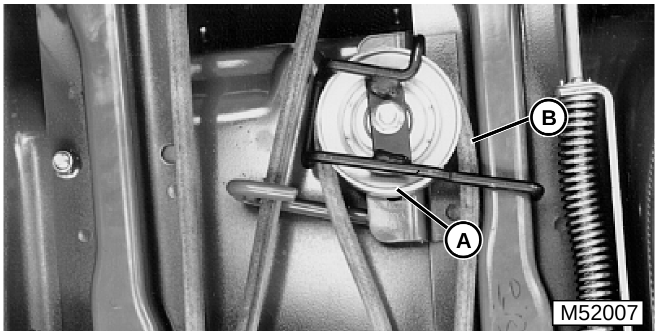
2. Remove PTO clutch (A).
3. Disconnect rods (B) from arm (C).



4. Remove guides (A & B), spring (C) and lever (D).
5. Loosen cap screw and slide sheave (E) forward to slacken belt.
6. Inspect spring (F) for cracks.

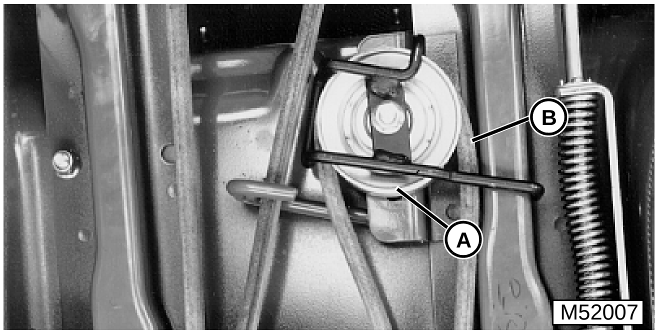


7. Remove sheave (A), belt from guide (B) and idler (C).

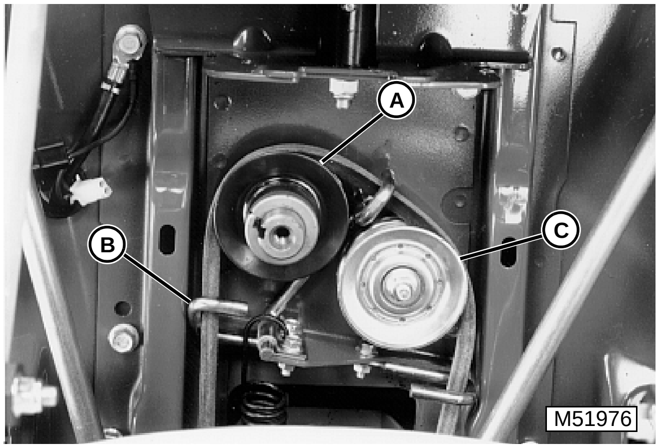


8. Remove belt from sheave (A). Belt and sheave may differ from depiction.
9. Pull belt through guide (B) and remove from tractor.

Installation



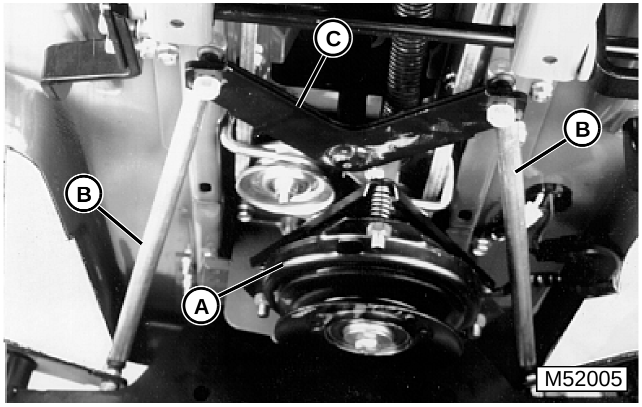
1. Push belt through guide (B).
2. Install belt on sheave (A).



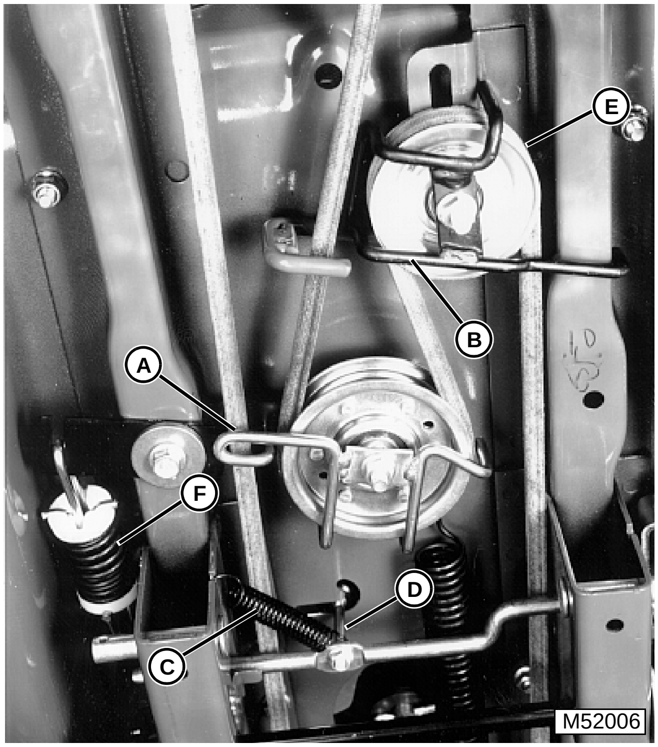
3. Install belt on guide (B) and idler (C).

NOTE: Apply NEVER-SEEZ® lubricant to crankshaft before installing sheave.

4. Install sheave (A).



5. Install spacer and PTO clutch (A).
6. Connect rods (B) to arm (C).



7. Install lever (D) spring (C).
8. Engage park brake.
9. Slide sheave (E) to rear until belt slack is removed. Tighten sheave.
10. Release park brake. Properly adjusted belt should result in spring (F) measurement of 47 mm (1.85 in.)

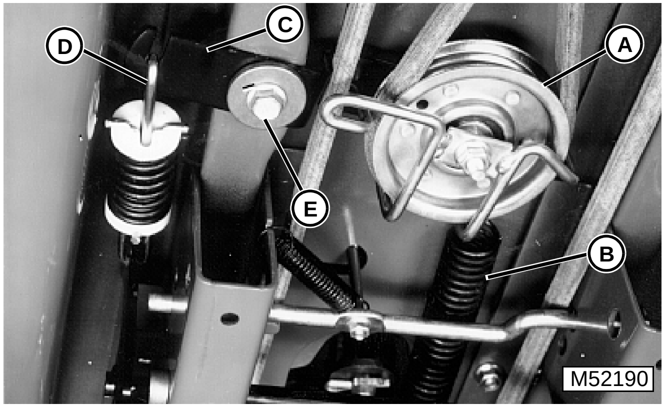
NOTE: Belt guides do not need adjustment.

11. Install guide (A). Be sure end of guide is in hole in clutch arm.
12. Install guide (B).

CLUTCH ARM REMOVAL/ INSTALLATION— STX30 & STX38 (SN —210000)

Removal

1. Engage park brake.



2. Remove guide and sheave (A).

⚠ CAUTION

Use locking pliers and wear safety glasses when removing spring.

3. Release park brake. Remove spring (B) from arm (C).
4. Remove spring (D) from arm.
5. Remove cap screw (E), bushing, and arm.
6. Inspect parts. Replace if necessary.

Installation

IMPORTANT: Always install cap screw (E) with thread lock and sealer (medium strength) or replace with epoxy cap screw. Machine damage can result.

1. Install arm (C), bushing, and cap screw (E). Tighten cap screw to 34 N•m (25 lb-ft).
2. Install springs (D) and (B). Engage park brake.
3. Install sheave (A) and guide. Be sure pin on guide fits in locating hole in clutch arm.

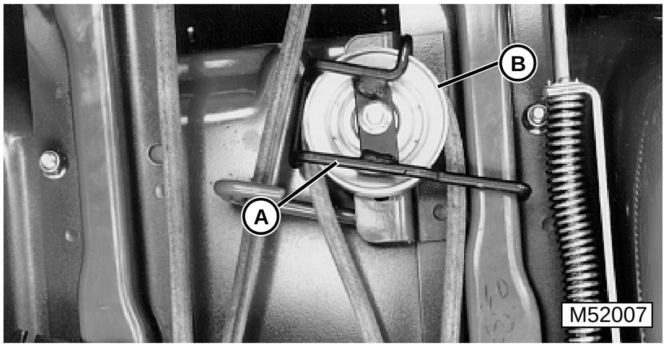
Specifications:

Cap Screw. 34 N•m (25 lb-ft)

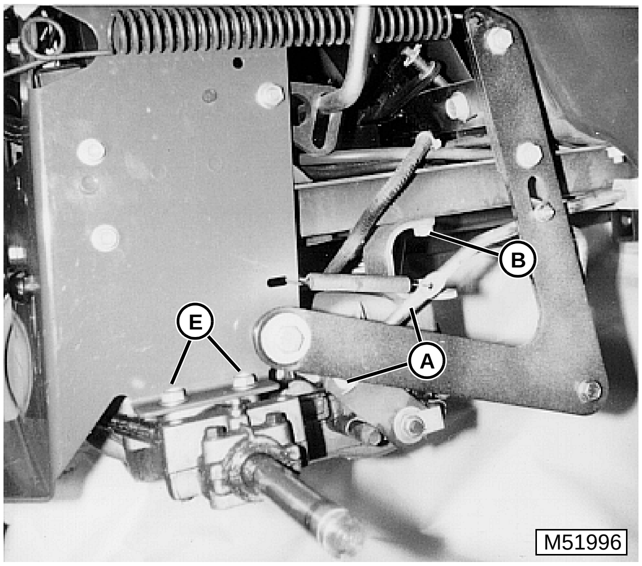
TRANSAXLE—REMOVAL/ INSTALLATION STX30 (SN —135158) (SN 160759—) & STX38 (SN —139614) (SN 185587—210000)

IMPORTANT: Several versions of Peerless Model Transaxles were used. 920-017 Model does not have grease fittings at the end of the axle housings. The 930-004 and 930-004A models have grease fittings at the end of the axle housing.

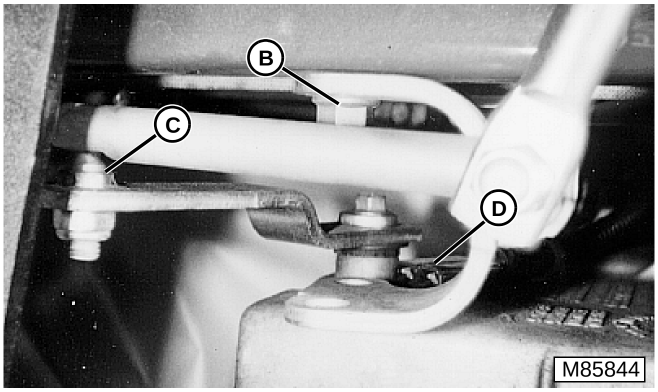
1. Remove ignition key and disconnect spark plug wire.
2. Raise rear of tractor and support safely.
3. Remove rear wheels.



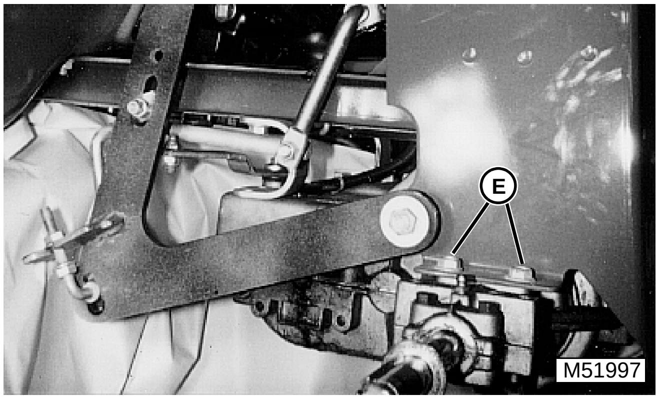
4. Remove guide (A).
5. Slide sheave (B) forward and remove belt from sheave.
6. Remove belt from transaxle sheave (not depicted).
7. Pull belt through transaxle guide (not depicted).



8. Disconnect linkage (A) from right side of transaxle.
9. Remove cap screw (B) from right side of transaxle. Do not remove cap screws (E) until step 11.

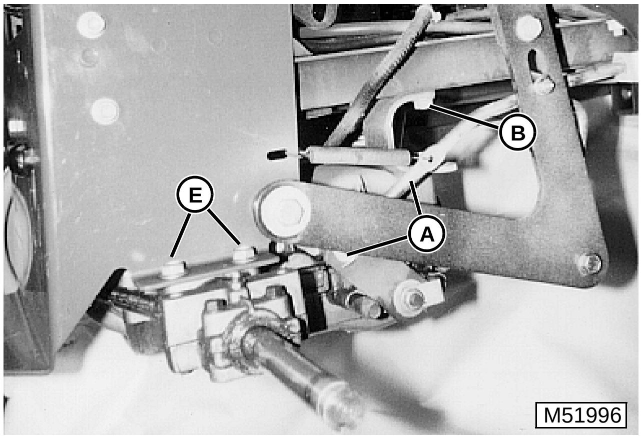


10. Disconnect linkage (C), unplug neutral start switch (D) and remove cap screw (B) from left side of transaxle.



11. Remove cap screws (E) and from left and right side to remove transaxle.

Installation

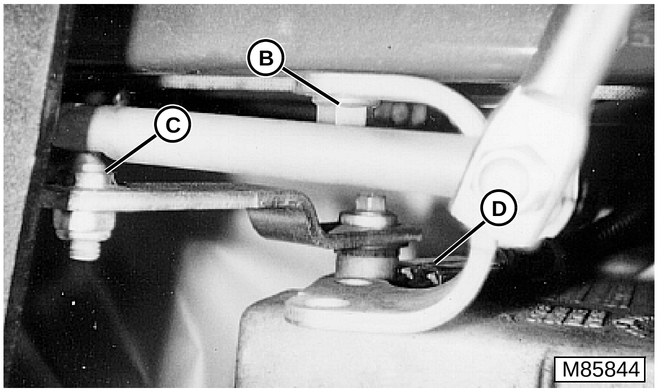


1. Install transaxle using cap screws (E). Do this for both left and right sides.
2. Connect linkage (A) and install cap screw (B) on right side of transaxle.

Specifications:

Transaxle Mounting Cap Screws to Hanger Bracket (Front) . . . . 15 N•m (132 lb-in.)

Transaxle Mounting Cap Screws to Frame (Rear) . . . 20.3—47.4 N•m (180—420 lb-in.)

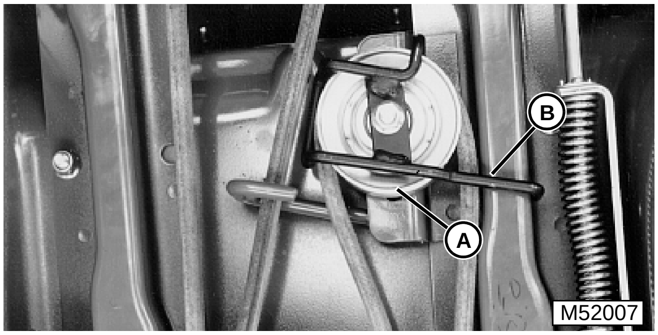


3. Connect linkage (C) on left side of transaxle.
4. Install cap screw (B).
5. Connect neutral start switch (D).

Specifications:

Transaxle Mounting Cap Screws to Hanger Bracket (Front) . . . . 15 N•m (132 lb-in.)

6. Push belt through transaxle guide (not depicted).
7. Install belt on transaxle sheave (not depicted).



8. Install belt on sheave (A).
9. Engage park lever.
10. Slide sheave to remove slack from belt. Tighten sheave cap screw.
11. Install guide (B).
12. Install wheels.

Specifications:

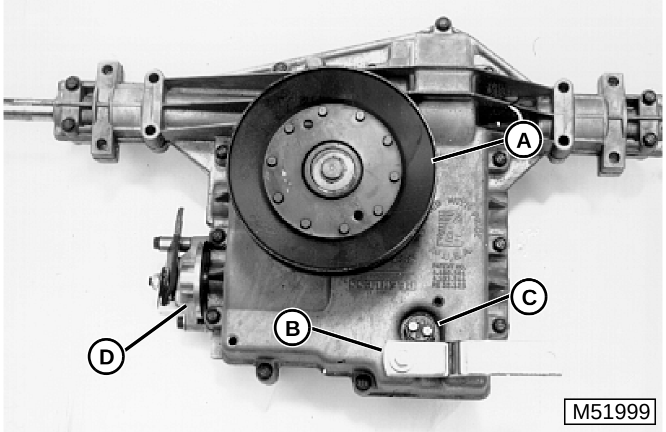
Sheave Cap Screw . . . . 95 N•m (70 lb-ft)

TRANSAXLE CASE—DISASSEMBLY STX30 (SN —135158) (SN 160759—) & STX38 (SN —139614) (SN 185587—210000)

PEERLESS MODEL 920-017, 930-004, & 930-004A

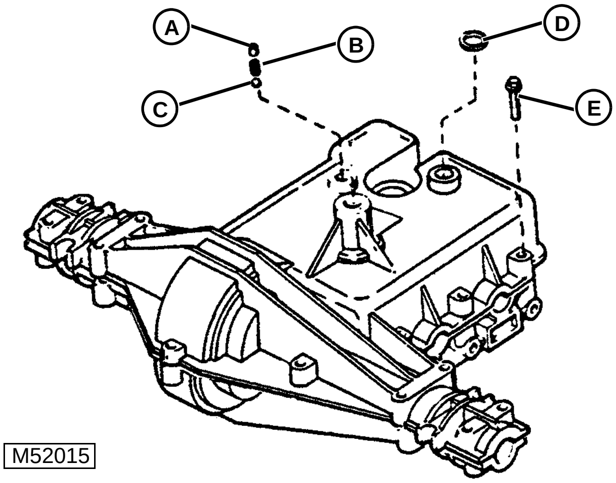
NOTE: Model 930 transaxles only—Peerless made a change in the transmission case pocket which holds the differential gears. It is now possible that a tolerance stackup could result in the upper case forcing the ends of the axles against the spider gear pin. This would cause the axles to turn hard or even lock them up. If this happens grind 0.002 inch off the inboard side of the axles. If the axles are not free after assembly, grind and additional amount from the axle until they do turn freely.

IMPORTANT: Early models (SN —210000) used several versions of Transaxle. 920 model does not have grease fittings at the end of the axle housing. The 930 and 930A models have grease fittings at the end of the axle housing. The following Serial Numbers M00STXA135159—160758 and M00STXB139615—185586 use model 915 transaxles and require silver colored neutral start switch. Units outside these serial numbers, below or above, were built with model 930 transaxles and require bronze colored neutral start switch.



M51999

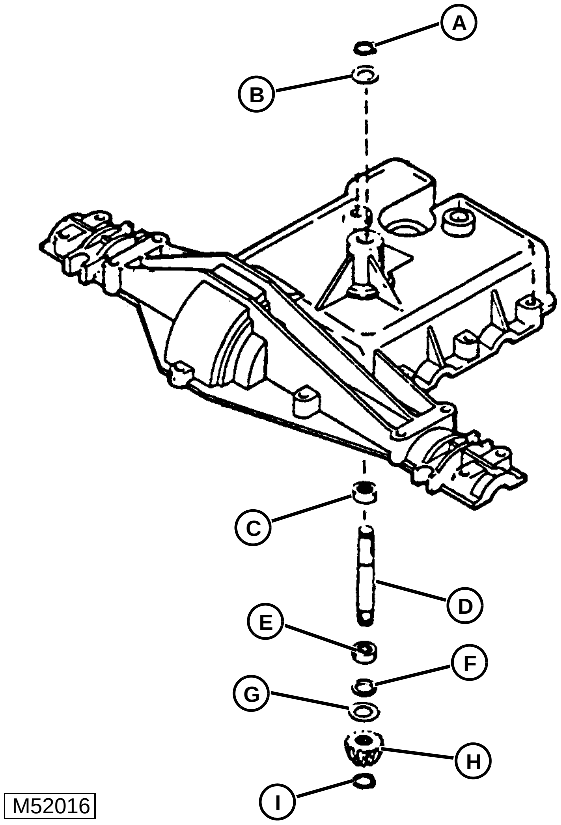
1. Remove snap ring and sheave (A).
2. Put lever (B) in neutral and remove.
3. Remove neutral start switch (C).
4. Remove brake assembly (D).



M52015

5. Remove seal (D).
6. Remove set screw (A).
7. Use magnet to remove spring (B) and ball (C).
8. Replace spring and ball if defective.
9. Remove cap screws (E).

Input Shaft—Disassemble



M52016

1. Remove snap ring (I) and disassemble input shaft assembly.
2. Inspect bearings (C) for roughness. Replace if necessary.
3. Inspect pinion for damage and wear. If worn or damaged, also check ring gear.

Counter Shaft—Disassemble

1. Remove shifter fork from brake shaft assembly.
2. Remove brake shaft and counter shaft assemblies.

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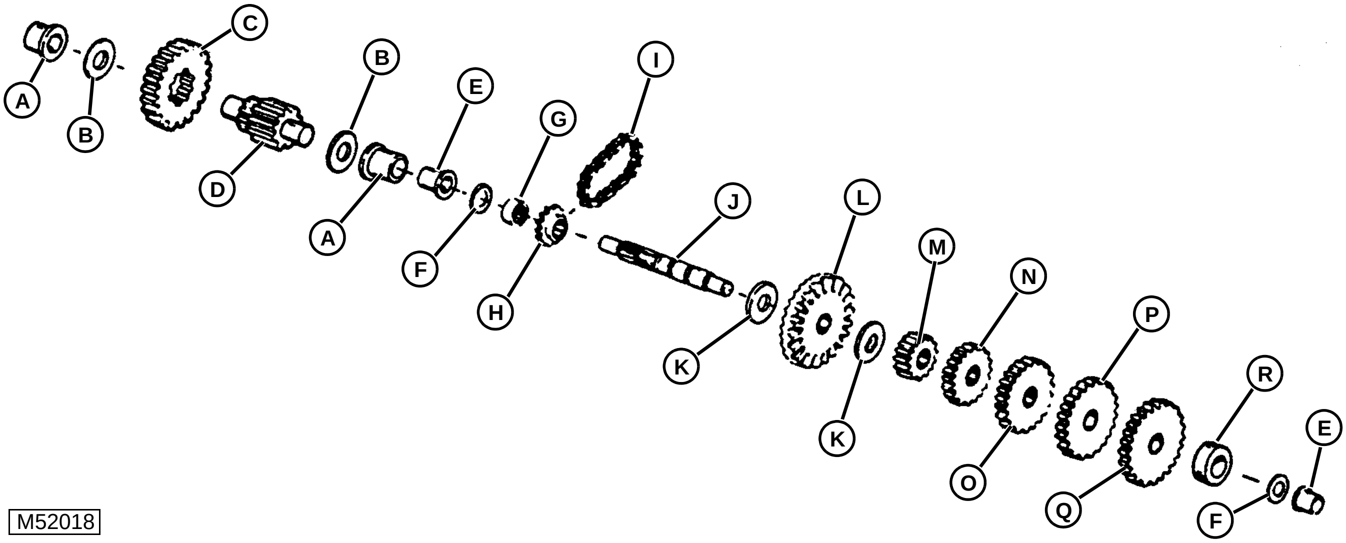
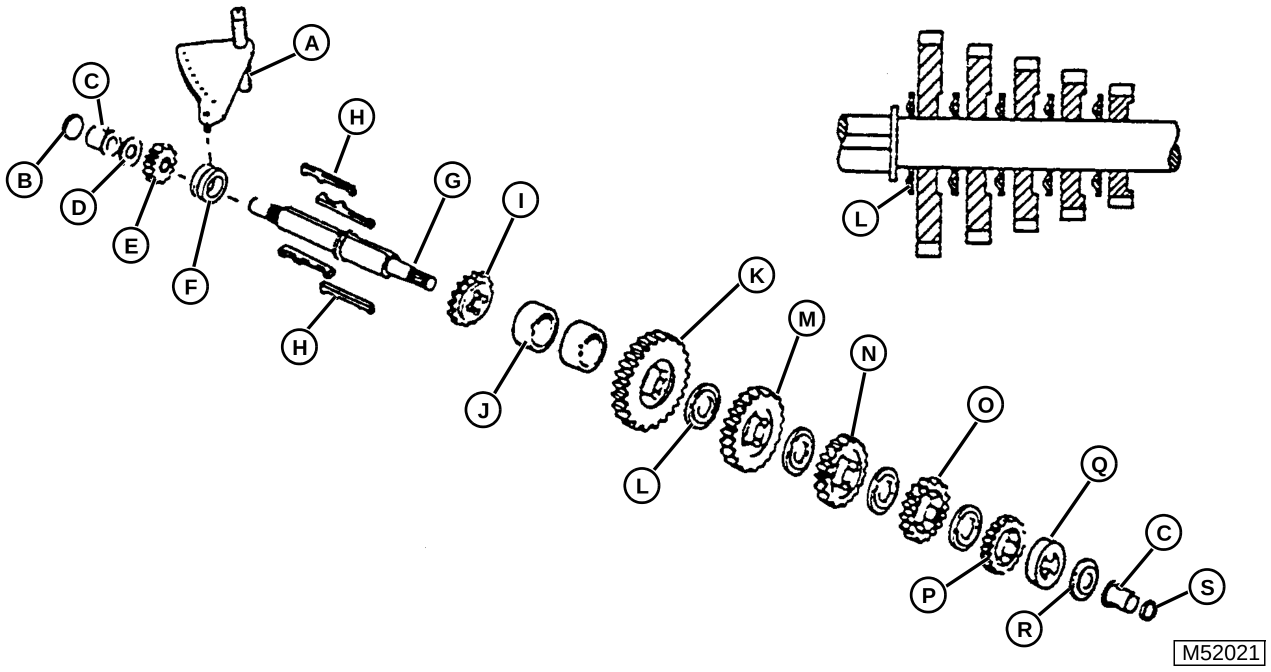


3. Remove bushing (A), washer (B), and output gear (C) from pinion (D).
4. Remove pinion (D), washer (B), and bushing (A).
5. Remove bushing (E), washer (F), and spacer (G) from shaft (J).
6. Pull ends of counter and brake shafts together and remove chain (I).
7. Remove 9 tooth gear (H).
8. Remove bushing (E), washer (F), and spacer (R).
9. Remove 28 tooth gear (Q), 23 tooth gear (P), 20 tooth gear (O), 16 tooth gear (N), and 12 tooth gear (M).
10. Remove washers (K) and 42 tooth gear (L).

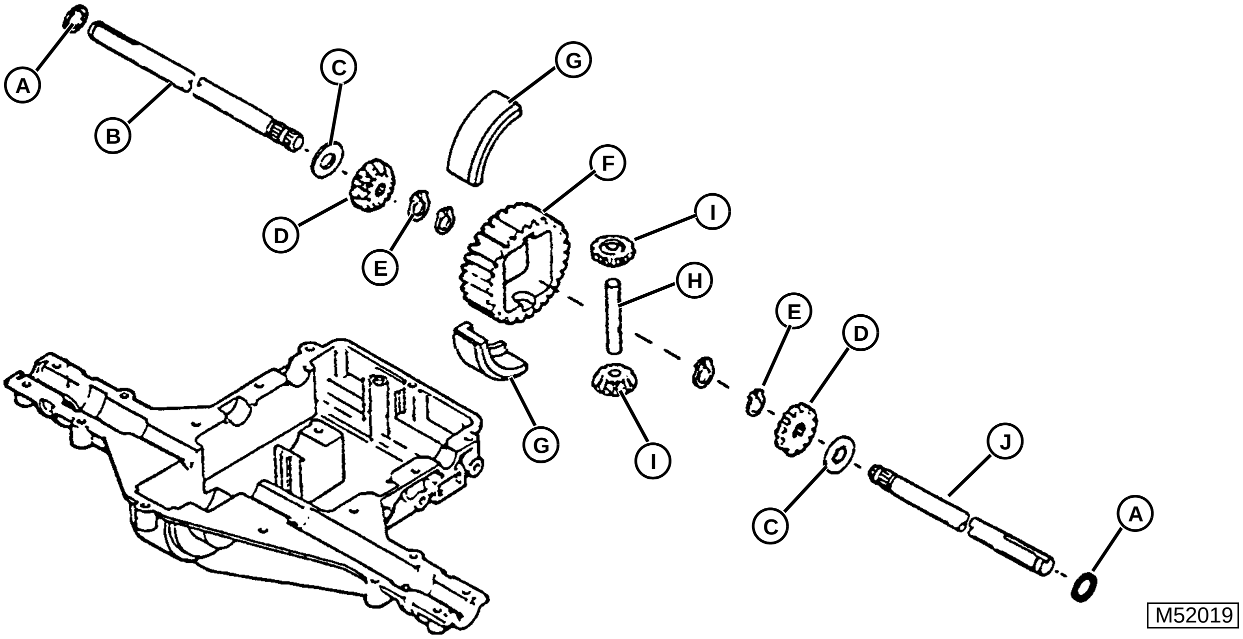
Brake Shaft—Disassemble



1. Remove disc (B), bushing (C), washer (D), and 15 tooth gear (E) from shaft (G).
2. Remove collar (F) and keys (H) from shaft (G).
3. Remove seal (S), bushing (C), washer (R), and spacer (Q).
4. Alternately remove 22 tooth gear (P), 27 tooth gear (O), 30 tooth gear (N), 34 tooth gear (M), and 37 tooth gear (K), and washers (L).
5. Remove spacers (J) and 18 tooth sprocket (I).

Differential—Disassemble

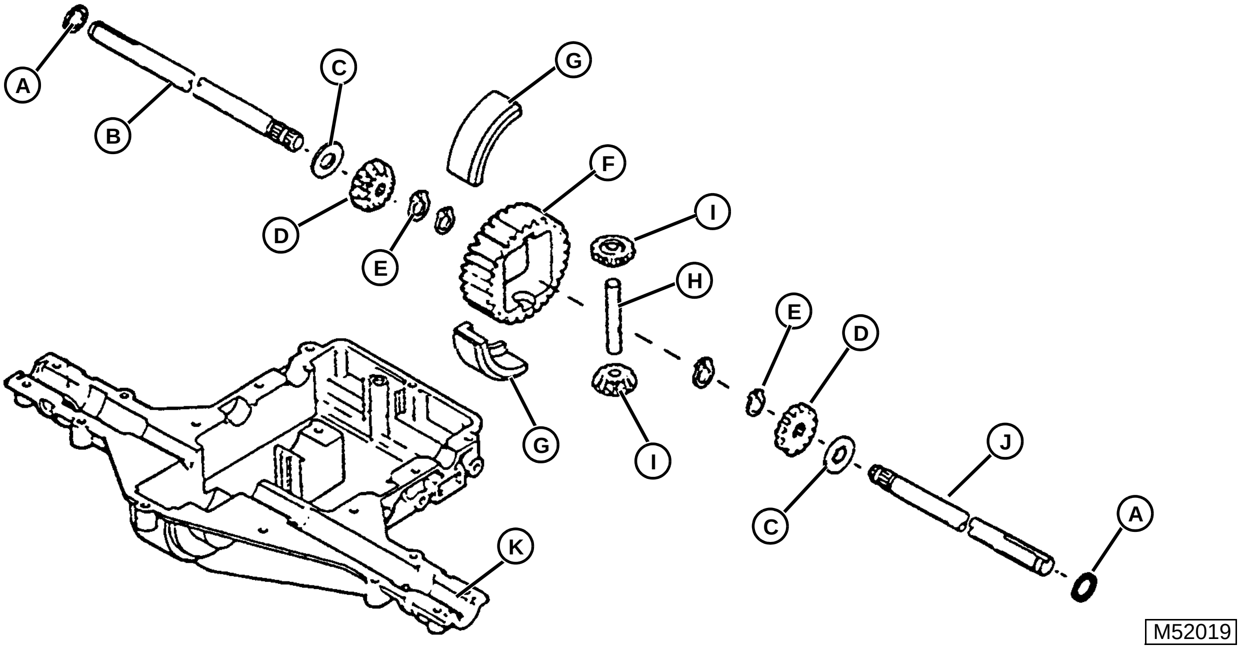
1. Remove differential assembly from lower case.



2. Remove blocks (G).
3. Remove axle (B) assembly.
4. Remove axle (J) assembly.
5. Remove seals (A) from axles.
6. Remove retainers (E), gear (D), and washer (C) from axles.
7. Remove pin (H) and gears (I) from gear (F).

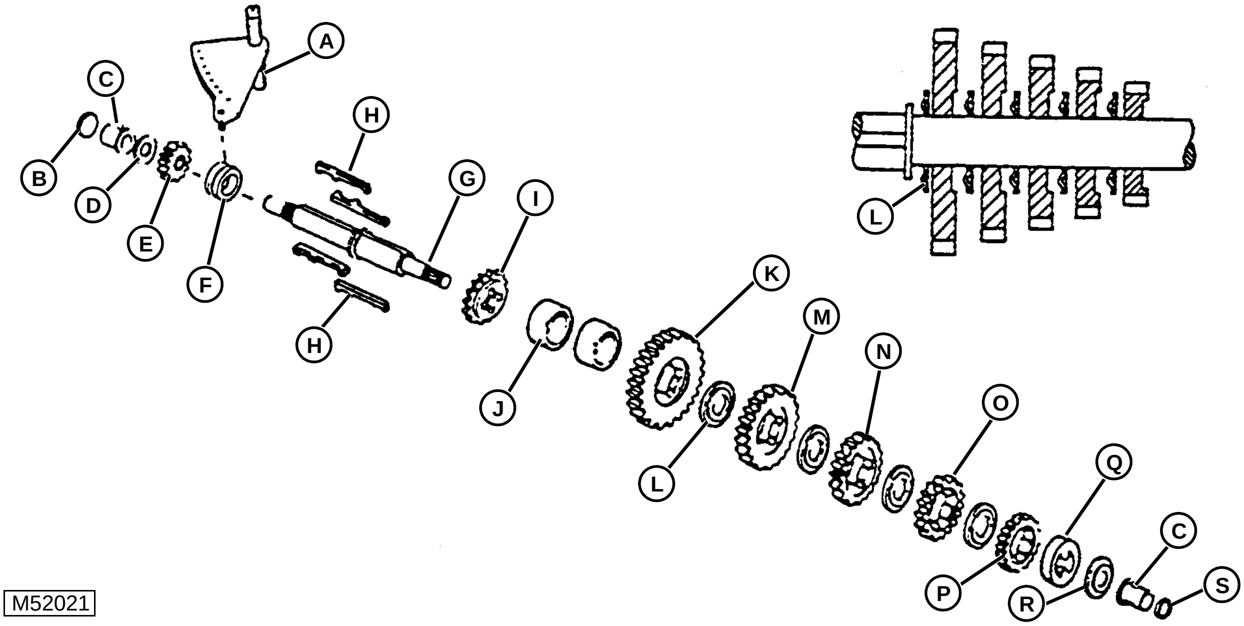
TRANSAXLE CASE—ASSEMBLY STX30 (SN —135158) (SN 160759—) & STX38 (SN —139614) (SN 185587—210000)

Differential—Assemble



1. Apply 11 mL (0.40 oz) High Temperature EP Grease to each area (K)—this is subtracted from total quantity used.
2. Install pin (H) and gears (I) in gear (F).
3. Install washer (C), gear (D), and retainers (E) on axles.
4. Install seals (A) on axles.
5. Install axle (J) assembly into gear (F).
6. Install axle (B) assembly into gear (F).
7. Install blocks (G) and differential gear assembly into lower case.

Brake Shaft—Assemble

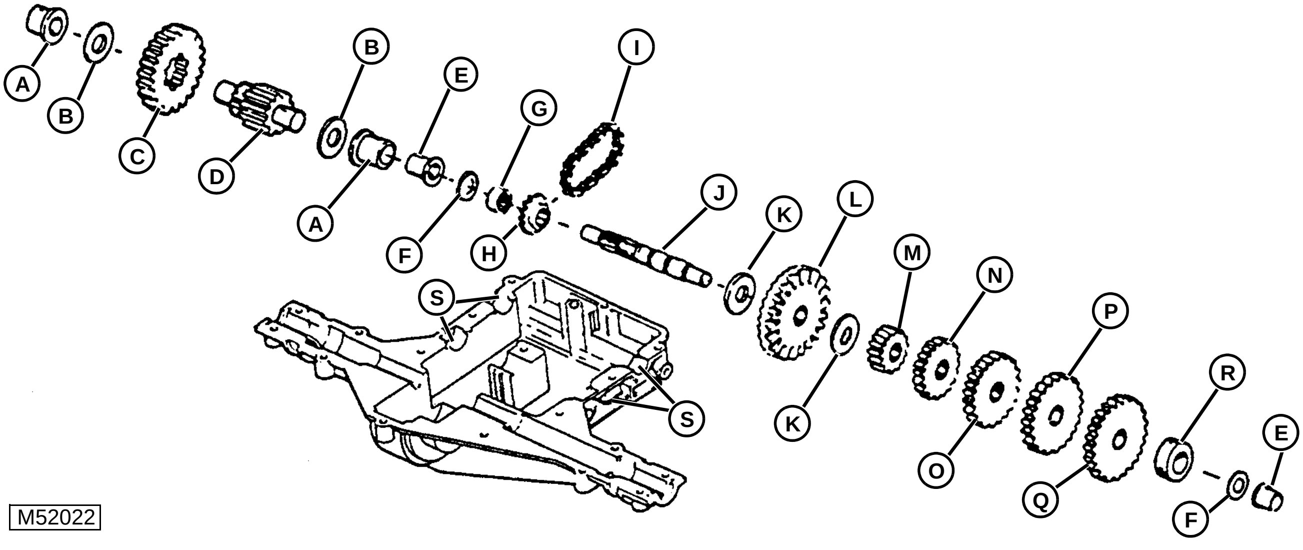


1. Put LUBRIPLATE lubricant in keyways of shaft (G).
2. Position keys (H) near end of shaft in keyways. Install collar (F) over keys with thicker shoulder of collar towards shaft.
3. Install gear (E—15 teeth) with thicker shoulder towards collar (F).

NOTE: Grease ends of shaft before installing bushings.

4. Install washer (D), bushing (C), and disc (B).
5. Install sprocket (I) and spacers (J).
6. Raised side of washers (L) and flat side of gears MUST face shoulder of shaft.
7. Install gears (K—15 teeth), (M—15 teeth), (N—15 teeth), (O—15 teeth), and (P—15 teeth) alternately with washers (L).
8. Install spacer (Q) and washer (R).
9. Install bushing (C).
10. Install seal (S).

Counter Shaft—Assemble

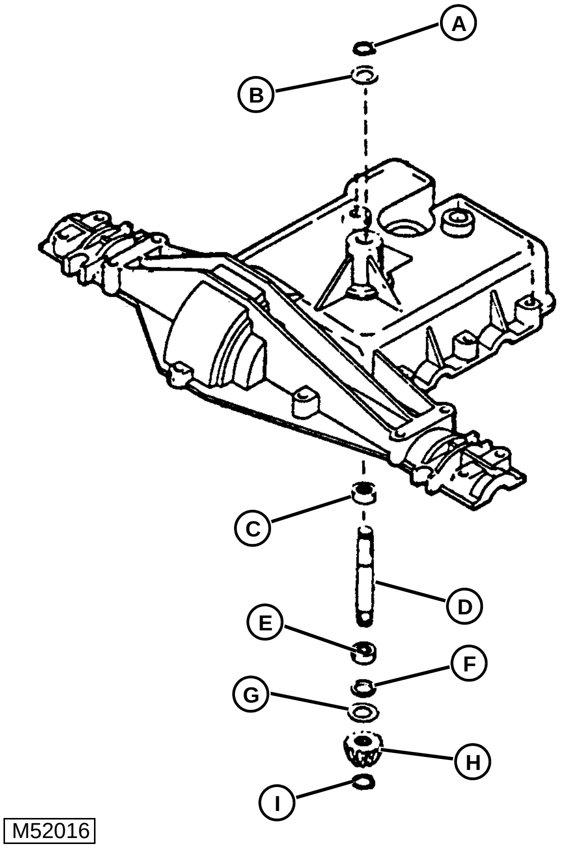


1. Install washer (K) and gear (L) with bevel towards center of shaft.
2. Install washer (K).
3. Install gears (M), (N), (O), (P), and (Q).
4. Install spacer (R) and washer (F).

NOTE: Grease ends of shaft before installing bushings.

5. Install bushing (E).
6. Install gear (H).
7. Put counter and brake shaft ends together and install chain (I).
8. Install spacer (G), washer (F), and bushing (E).
9. Install gear (C) on assembly (D).
10. Install washers (B) and bushings (A).
11. Grease points (S).
12. Install counter and brake shaft assemblies in case.
13. Install shifter fork.

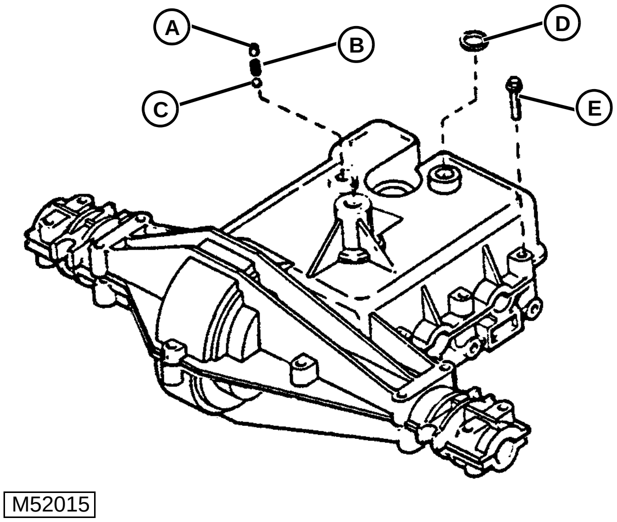
Input Shaft—Assemble



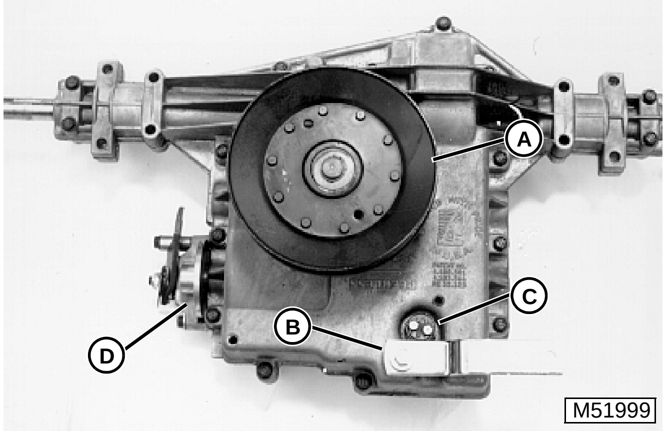
1. If new bearings (C) are used, press top bearing flush with cover. Press lower bearing to depth of 3.43—3.81 mm (0.135—0.150 in.) inside cover.
2. Install washer (B) and O-ring (A) on shaft (D).
3. Install O-ring (F) and washer (G).
4. Install gear (H) and snap ring (I).

Case—Assemble

1. Fill case with John Deere Moly High Temperature EP Grease. Transaxle capacity is 1.0 L (30 oz).



2. Apply silicone sealant and install top cover. Torque cap screws (E) to 11.3 N•m (100 lb-in.).
3. Install ball (C), spring (B), and set screw (A). Tighten screw one turn below flush with cover.
4. Install seal (D).
5. Turn input shaft to check for binding.



6. Install brake assembly (D).

NOTE: Correct neutral start switch is normally closed.

7. Install neutral start switch (C).
8. Install lever (B). Use LOCTITE® and tighten cap screw to 16 N•m (144 lb-in.).
9. Install sheave (A) and snap ring on earlier models. On later models tighten nut to 40 N•m (30 lb-ft).

Specifications:

Transaxle Cover Cap Screw . . 11.3 N•m (100 lb-in.)
Shift Lever Cap Screw . . . . 16 N•m (144 lb-in.)
Sheave Nut (Later Models) . . . . 40 N•m (30 lb-ft)

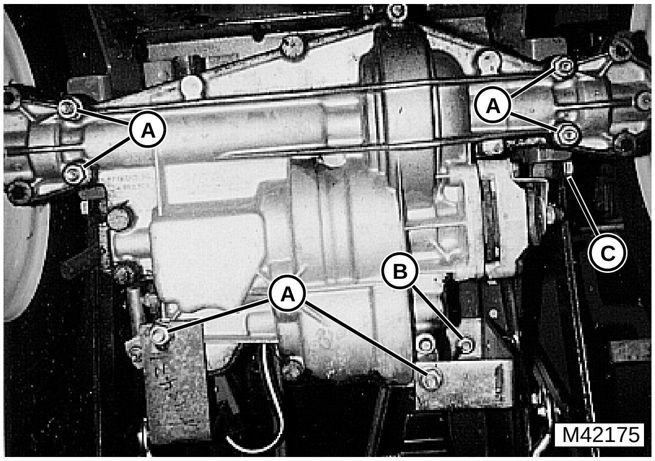
TRANSAXLE—REMOVAL/ INSTALLATION STX30 (SN 135159—160758) & STX38 (SN 139615—185586)

(PEERLESS MODELS 915-012A & 915-012B)

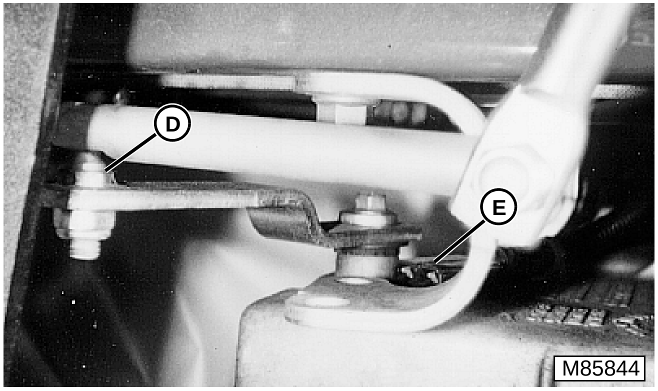
IMPORTANT: Early models used several versions of transaxle. The 915 model is used in the 1992 production models and has a completely different shape then the older models.

Removal

1. Remove ignition key and disconnect spark plug wire.
2. Raise rear of tractor and support safely.
3. Remove rear wheels.



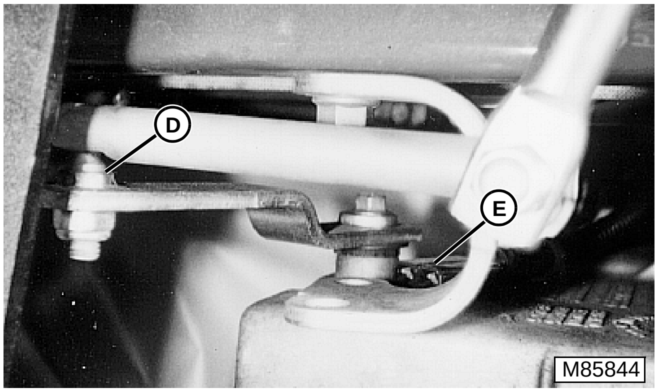
4. Loosen transaxle mounting cap screws (A) and frame-to-bracket nuts (B) (Right-hand shown).
5. Disconnect brake linkage (C).



6. Disconnect shift linkage (D), and neutral switch (E).
7. Depress clutch pedal and remove drive belt from transaxle drive sheave.
8. Remove mounting cap screws and remove transaxle.

Installation

1. Install transaxle leaving hardware loose.
2. Install drive belt.



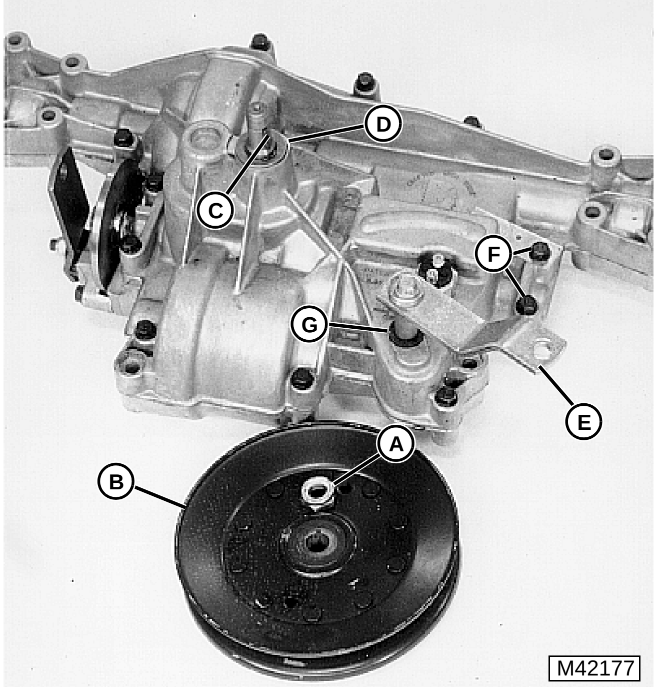
3. Connect brake linkage (C)—see depiction step 4, shift linkage (D) and neutral switch (E).
4. Tighten mounting cap screws and install rear wheels.

Specifications:

Transaxle Mounting Cap Screws to Hanger Bracket (Front) . . . . 15 N•m (132 lb-in.)

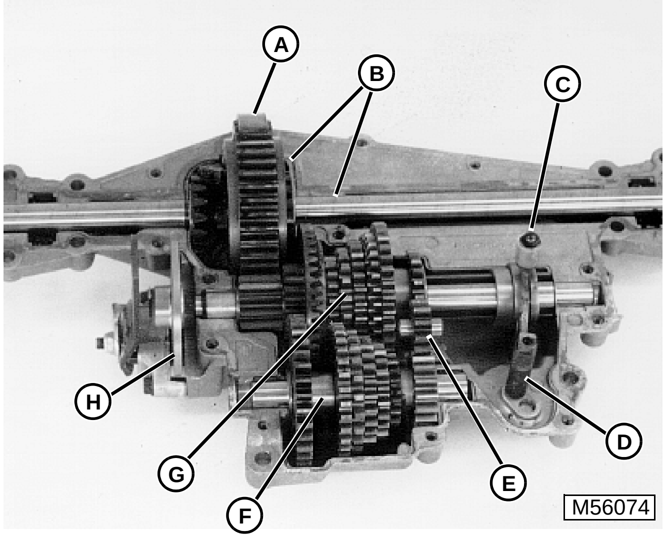
Transaxle Mounting Cap Screws to Frame (Rear) . . . 20.3—47.4 N•m (180—420 lb-in.)

TRANSAXLE CASE—DISASSEMBLY STX30 (SN 135159—160758) & STX38 (SN 139615—185586)



NOTE: When separating transaxle cover, detent ball and spring may fall out. Reverse idler shaft may also drop. Work cover up evenly over shifter fork.

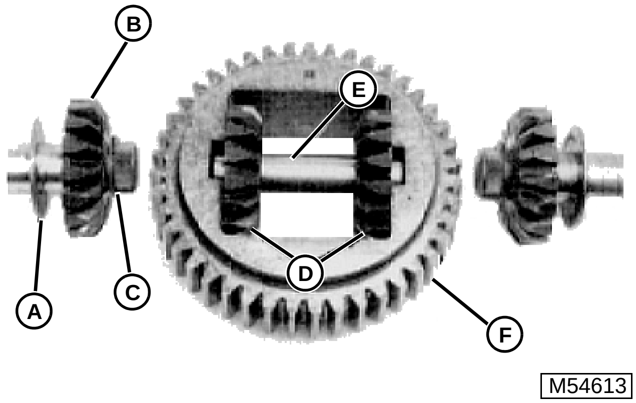
1. Remove cover cap screws (F), shift arm (E) and dust seal (G).
2. Remove nut (A) and sheave (B).
3. Remove key (C) and washers (D).



NOTE: Note position of parts for reassembly. Lay parts out in a systematic order to aid assembly. Check all gears for wear, replacing mating gears as a set.

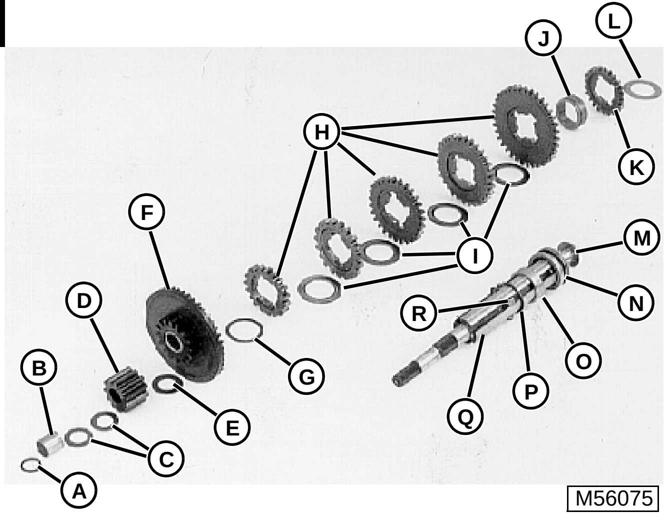
4. Remove grease slinger (A) and axle—differential assembly (B).
5. Remove detent ball and spring (C).
6. Remove shift fork (D) and reverse idler (E).
7. Remove counter shaft (F), shift shaft assembly (G), and brake rotor (H).
8. Clean and inspect parts.

Differential



1. Remove snap rings (C), thrust washers (A) and bevel side gears (B).
2. Remove pinion gears (D) from pinion shaft (E).

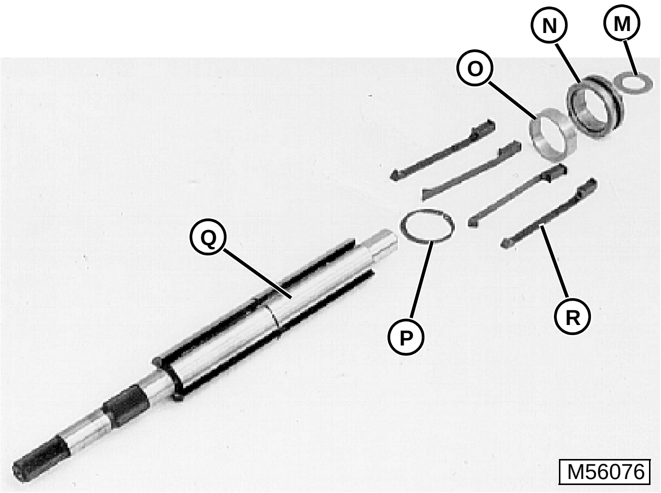
Shift Shaft



IMPORTANT: Pay close attention how shaft is originally assembled. Note the direction of detent washers and the direction the gears are facing.

A—O-Ring	**G—Key Stop Ring**	**M—End Washer**
B—Bushing	**H—Spur Gears**	**N—Shift Collar**
C—Washers (2)	**I—Detent Cone Washers (Rounded Side Toward Shift Keys)**	**O—Stop Collar**
D—Differential Drive Gear (Undercut Side)	**J—Neutral Collar**	**P—Snap Ring**
E—Washer	**K—Reverse Gear**	**Q—Shifter Brake Shaft**
F—Bevel Ring Gear	**L—Stop Washer**	**R—Shift Keys**

1. Remove and clean parts. Always install new O-rings.



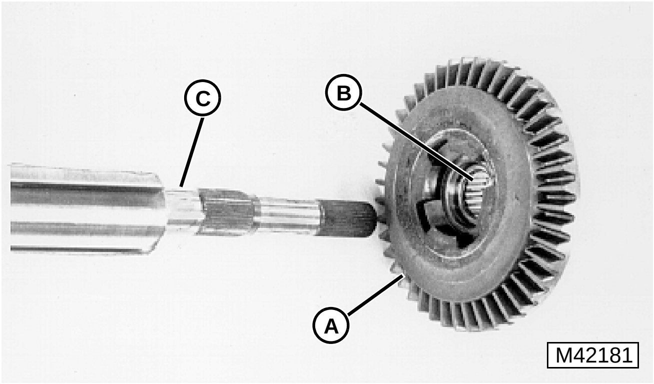
M—End Washer	**O—Stop Collar**	**Q—Shifter Brake Shaft**
N—Shift Collar	**P—Snap Ring**	**R—Shift Keys**

Assemble

1. Face undercut side of gears toward bevel gear.
2. Face detent cone washers toward shaft keys.
3. Face differential input gear with undercut side towards bevel gear.
4. Face undercut I. D. of shift collar towards bevel gear.

Input Bevel Gear

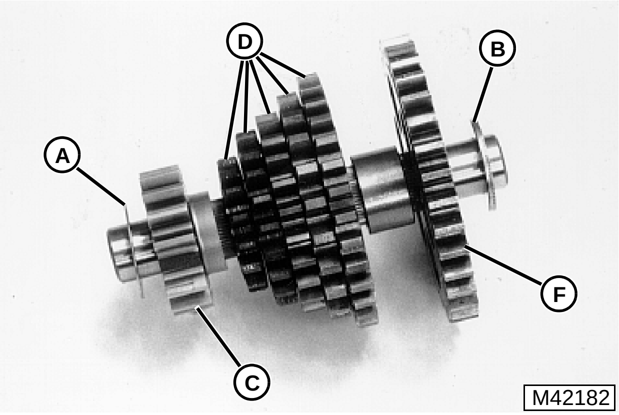
NOTE: Remove bearing only if replacement is necessary.



1. Remove and inspect input bevel gear (A) and bearing (B). If bearing is rough or pitted, check bearing surface (C).

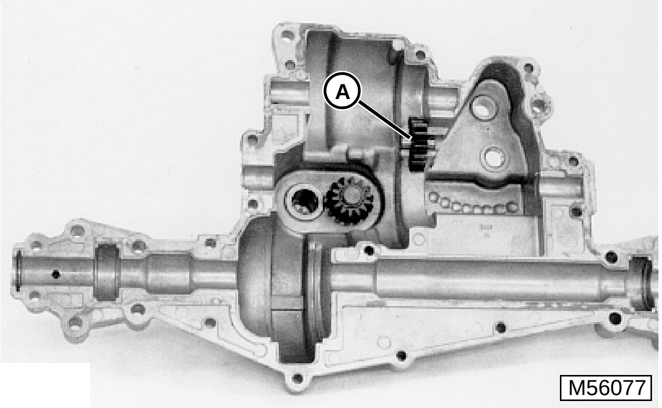
Counter Shaft

NOTE: The shaft bushing area is longer on one end. Note the direction in which the shaft was removed and the relationship of the gears to the shaft. The thick washer and longer shaft end should be install toward the brakes.



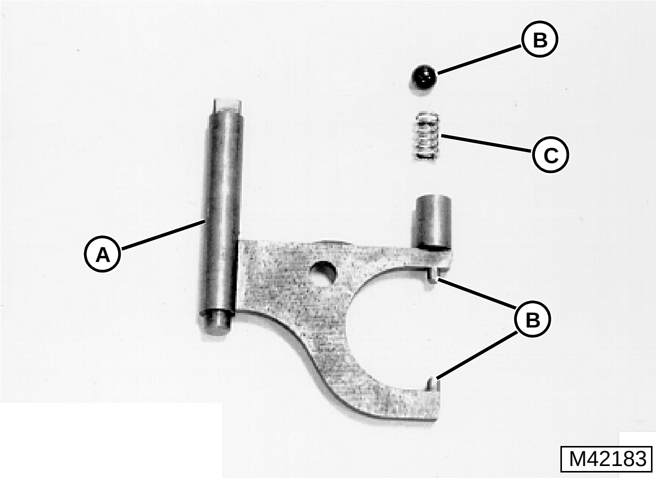
1. Inspect gear teeth (C, D, F) and splines and shaft splines for damage. Note the position of the thin (A) and thick (B) washers.

Reverse Idler



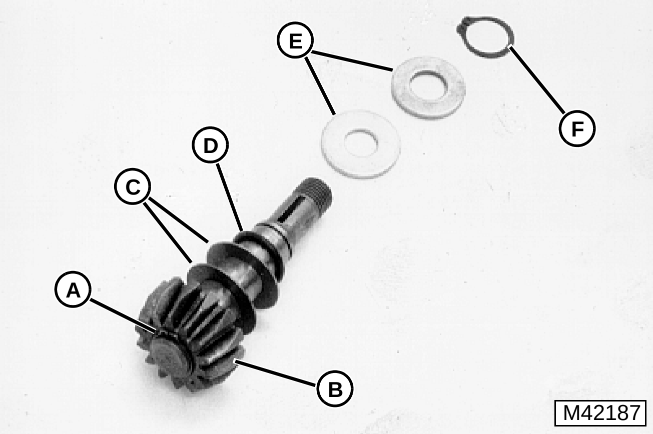
1. Check for excessive wear between idler (A) and case.
2. Check teeth and mating gears and replace as necessary.

Shift Lever and Detent

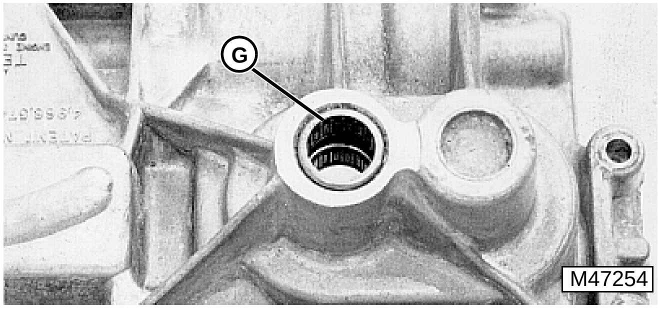


1. Check tabs (B) for wear. Replace shaft lever (A) if worn. Inner recessed bevel of lever must face toward gears.
2. Replace ball (B) and spring (C) if damaged.

Input Pinion Shaft



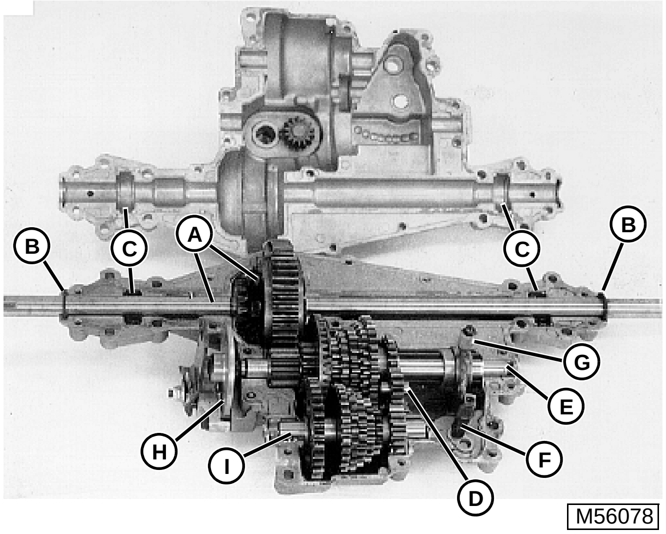
1. Remove snap ring (F) and washers (E).
2. Remove snap ring (A), pinion (B), washers (C) and O-ring (D).
3. Inspect pinion gear for wear.
4. Install new square cut O-ring seal.



5. Remove needle input bearings (G) only if necessary. Press top bearing in until it bottoms on flange. Install inside lower bearing 3.43—3.81 mm (0.135—0.150 in.) below flush with top surface of case.

REPAIR

TRANSAXLE CASE—ASSEMBLY STX30 (SN 135159—160758) & STX38 (SN 139615—185586)

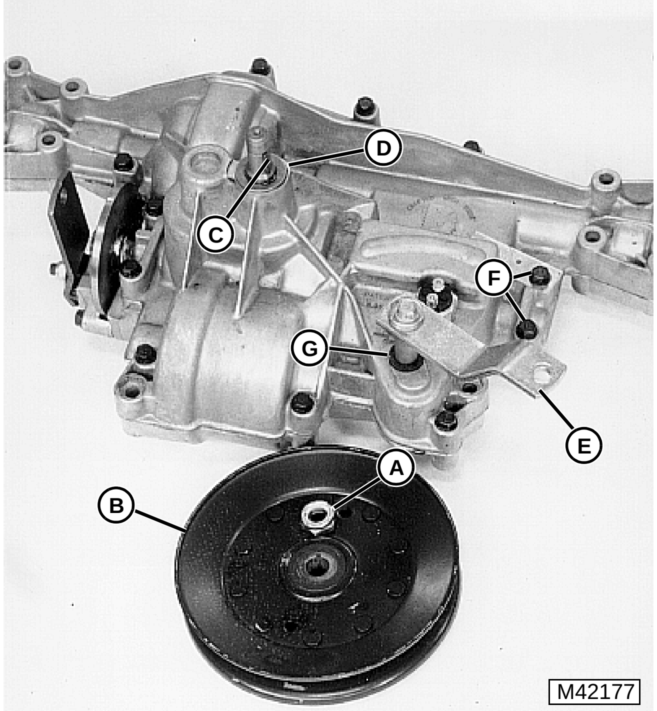


NOTE: Do NOT put grease between slinger and case.

1. Apply approximately 532 mL (18 oz.) of EP90 Lithium Grease (John Deere Moly, High Temperature EP Grease) to all transaxle components and wear areas.
2. Fill both cavities (C).
3. Apply a small bead of flexible sealant around case sealing surface.

NOTE: Make sure seals (B) are in place on axle.

4. Install brake assembly (H), shift shaft (E) and counter shaft assembly (I).
5. Install differential axle assembly (A).
6. Install shift lever (F) and ball and spring (G).
7. Carefully install top case. Do not displace detent ball and spring (G).
8. Make sure reverse idler gear (D) stays in position and allows case halves to close.



9. Install cover cap screws (F), dust seal (G) and shift arm (E).
10. Install washers (D) and key (C).
11. Tighten case retaining cap screws (F) down evenly. Tighten screws to 12 N•m (100 lb-in.)
12. Install sheave (B) and nut (A). Tighten nut to 40.7 N•m (30 lb-ft).

Specifications:

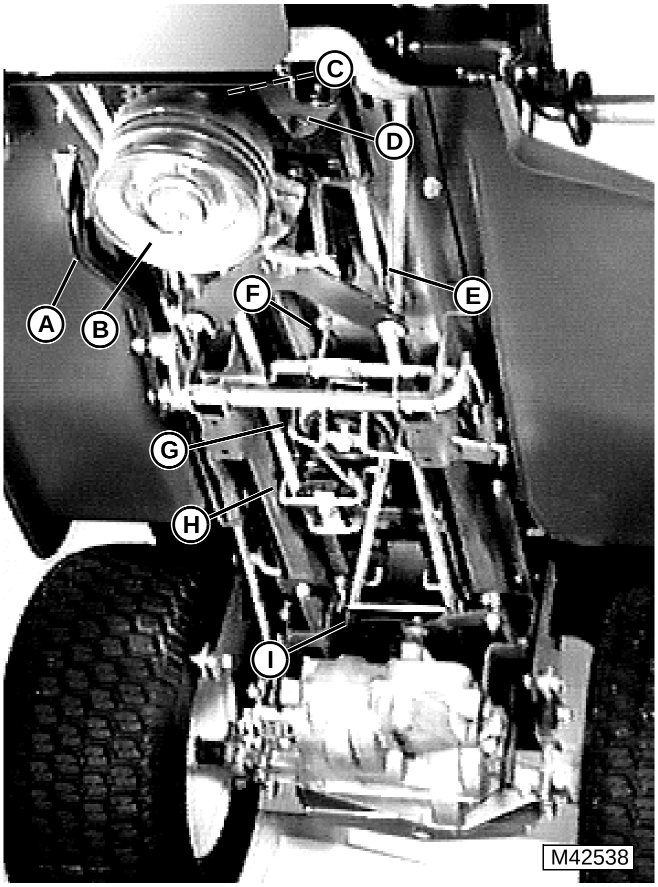
Case Retaining Cap Screws . . . . 12 N•m (100 lb-in.)
Sheave Nut . . . . 40.7 N•m (30 lb-ft)

TRACTION DRIVE BELT REMOVAL/ INSPECTION/INSTALLATION— STX38 & STX46 LATE MODEL

NOTE: *If drive belt is in good condition, it doesn't to be completely removed to take out the transaxle. Just lock the park brake to disengage it from the transaxle drive sheave.*

Removal:

1. Park tractor on level surface.
2. Remove mower deck.
3. Safely raise and block tractor to gain easy access to underside of frame.



4. Depress and lock pedal (A) into park with lever (F).
5. Remove front idler belt guide and sheave (D).
6. Remove PTO clutch assembly (B) and engine drive sheave (C).
7. Disconnect both steering rods (E) from steering yoke.
8. Remove bellcrank idler belt guide (G).
9. Remove adjustable idler belt guide (H).
10. Remove park lever (F).
11. Remove belt from transaxle drive sheave (I).
12. Remove belt from traction drive idlers and remaining belt guides.

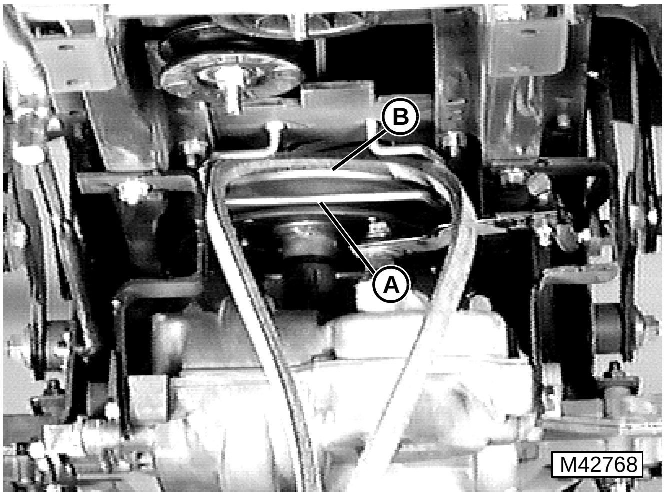
Inspection:

1. Examine belt to determine if it is worn, strecthed, cracked, frayed, or damaged beyond the point of continued use.
2. Measure and compare removed belt to following new belt dimensions:

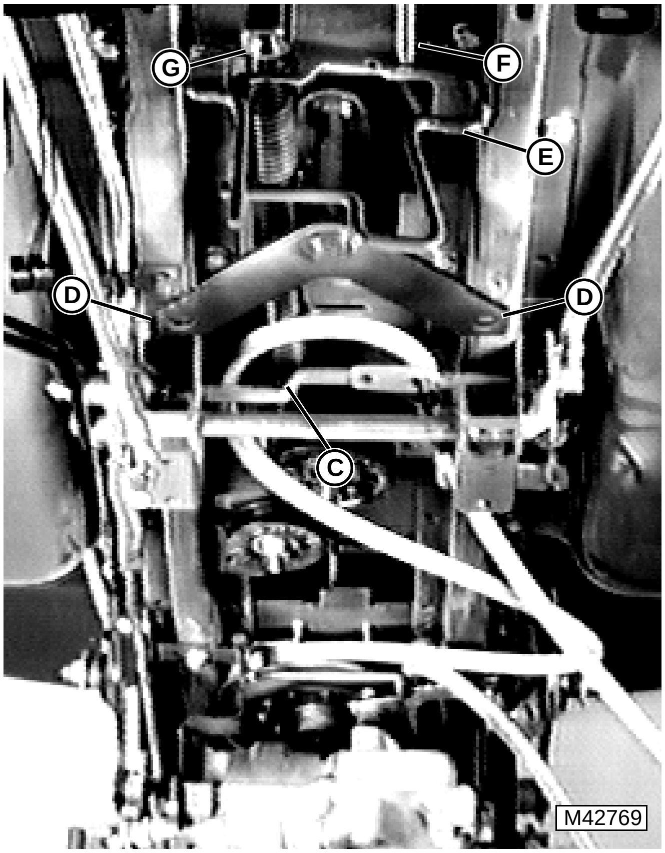
Effective length . . . . 2660±8 mm (104.7±0.3 in.)
Minimum effective length (short) . . . . 2631 mm (103.6 in.)
Maximum effective length (long) . . . . 2710 mm (106.7 in.)
Effective top width . . . . 13.5 mm (0.53 in.)
Minimum effective top width. . . . . . 11 mm (0.43 in.)
Effective bottom width . . . . 7.5 mm (0.3 in.)
Minimum effective bottom width . . . . 5 mm (0.2 in.)
Effective depth . . . . 9.5 mm (0.37in.)
Minimum effective depth. . . . . 7 mm (0.28 in.)

3. Replace belt if any of above dimensions are not found.

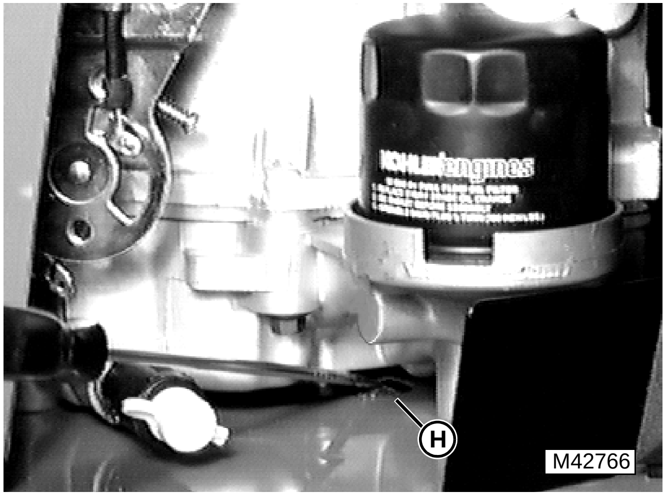
Installation:



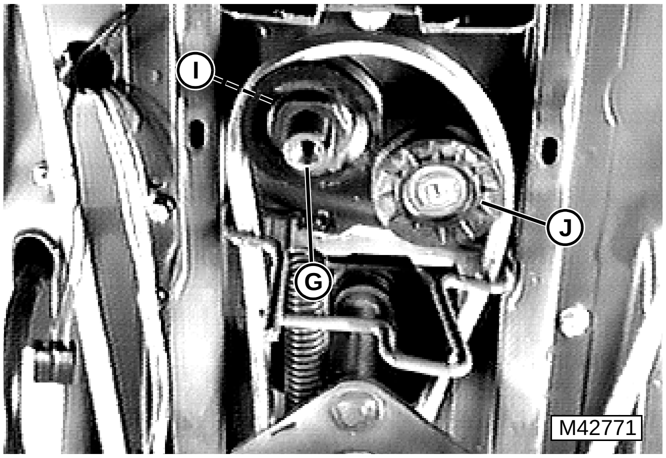
1. Install drive belt through rear belt guide (A) and over transaxle drive sheave (B).



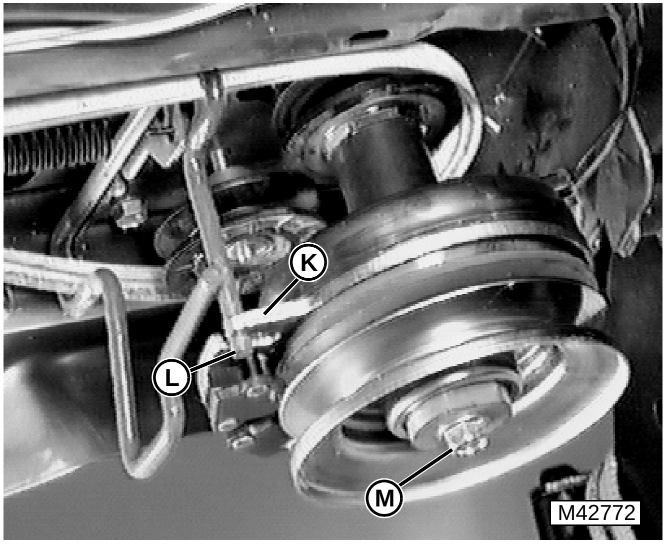
2. Pull drive belt over the top of park rod (C), down and around steering arms (D), up through forward belt guide (E), over front idler carriage cap screw (F), and engine output shaft (G).



NOTE: It may be helpful to hold front idler carriage cap screw (H) in place by wedging a thin bladed screw driver between cap screw head and frame.



3. Coat engine output shaft (G) and inside surface of traction drive sheave (I) with John Deere Never-Seez® before installing drive sheave. (Hint: hold sheave in place by seating drive belt in sheave groove.)
4. Install front idler (J). (Hint: hold idler in place by seating drive belt in sheave groove.)



5. Coat inside surface of PTO clutch with John Deere Never-Seez® before installing it onto engine output shaft. BE SURE to align anchor slot (K) with belt guide rod (L).
6. Tighten PTO clutch cap screw (M) to 75 N•m (55 lb-ft).
7. Perform Clutch/Brake Pedal Linkage Adjustments, shown earlier in this section.

TRACTION DRIVE SYSTEM REMOVAL/INSPECTION/ INSTALLATION— STX38 (SN 210001—) & STX46

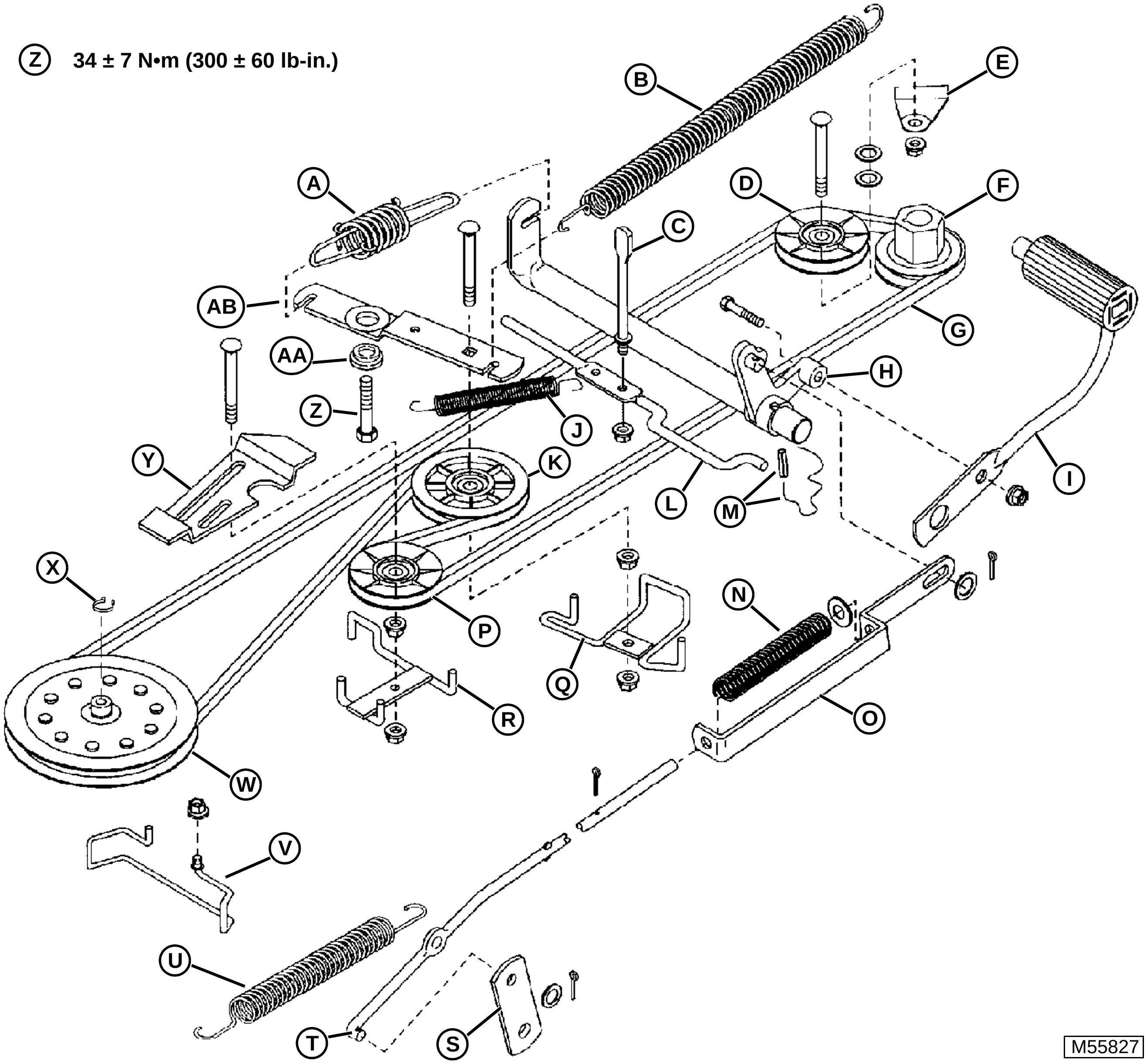
Removal/Inspection/Installation:

1. Remove mower deck.
2. Use this drawing for complete repair of system
3. Install mower deck.

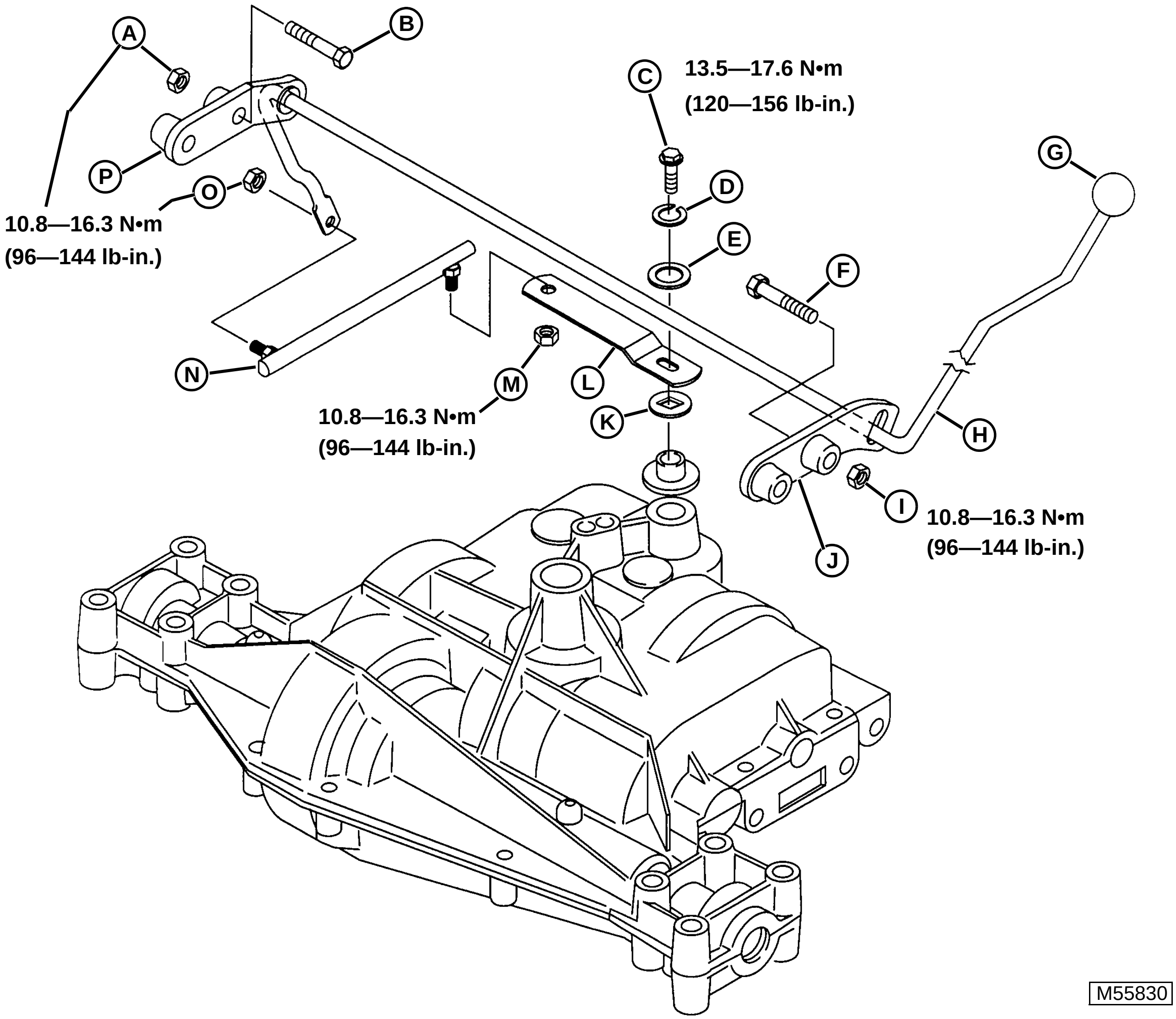
⚠ CAUTION

Clutch bellcrank spring is under high tension. Use locking pliers or spring puller tool and wear safety glasses when removing clutch bellcrank spring.

A–Bellcrank Spring
B–Tension Spring
C–Park Latch
D–Front Idler
E–Belt Guide #1
F–Crankshaft Drive Sheave
G–Drive Belt
H–Pivot Shaft Assembly
I–Clutch/Brake Pedal
J–Park Latch Spring
K–Clutch Sheave
L–Park Rod
M–Rolled Pin & Wire
N–Brake Spring
O–Brake Bracket
P–Adjustable Idler
Q–Belt Guide #2
R–Belt Guide #3
S–Brake Lever
T–Brake Rod
U–Brake Return Spring
V–Belt Guide #4
W–Transaxle Sheave
X–Snap Ring
Y–Adjust. Idler Bracket
Z–Clutch Bellcrank Cap Screw
AA–Bushing
AB–Clutch Bellcrank


Ⓩ 34 ± 7 N•m (300 ± 60 lb-in.)

SHIFT LINKAGE REMOVAL/INSTALLATION STX38 (SN 210001—) & STX46



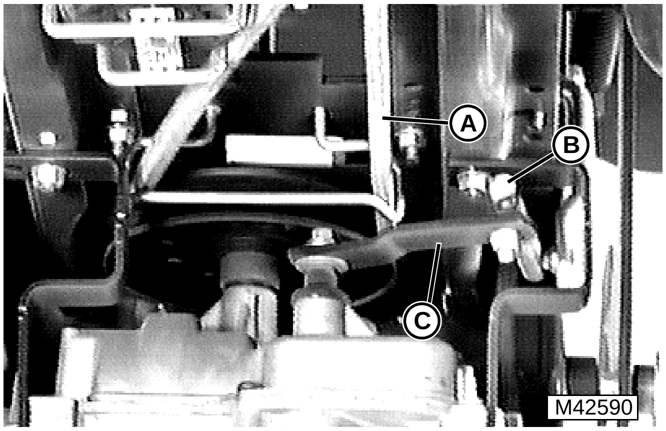
1. Remove battery.
2. Block rear of tractor off surface so you can remove left drive wheel.
3. Remove shift knob (G).
4. Remove lock nuts (M and O) to remove shift link (N).
5. Remove lock nuts (A and I) and cap screws (B and F).
6. Adjust mounting brackets (J and P) so shift rod (H) can be removed from the left side of the frame. You will have to “snake” the shift rod from the tractor.
7. Remove cap screw (C) to remove shift lever (L) and washers (D, E, and K).
8. Replace necessary components.
9. Install shift linkage in reverse order of removal.
10. Tighten shift lever cap screw and lock nuts to specifications shown above.

A–Lock Nut
B–Cap Screw
C–Shift Lever Cap Screw
D–Lock Washer
E–Washer
F–Cap Screw
G–Shifter Knob
H–Shift Rod
I–Lock Nut
J–Right-Hand Bracket
K–Special Square-Hole Washer
L–Shift Lever
M–Lock Nut
N–Shift Link
O–Lock Nut
P–Left-Hand Bracket

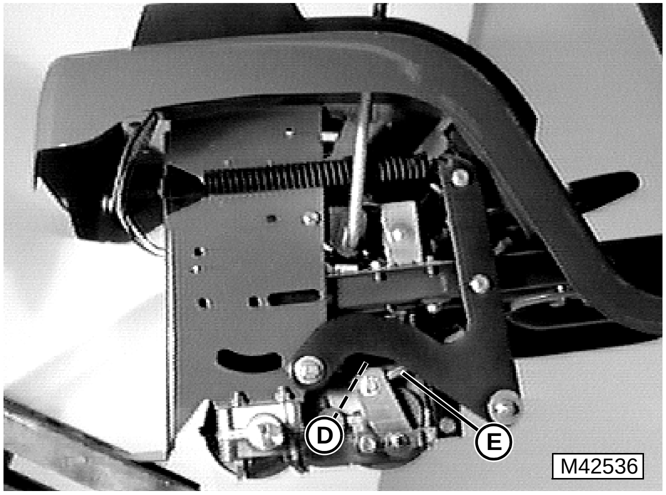
TRANSAXLE—REMOVAL/ INSTALLATION STX38 (SN 210001—) & STX46

IMPORTANT: STX38 (SN 301383—) transaxle differs slightly from STX38 (SN 210001—301382) and STX46 transaxle.

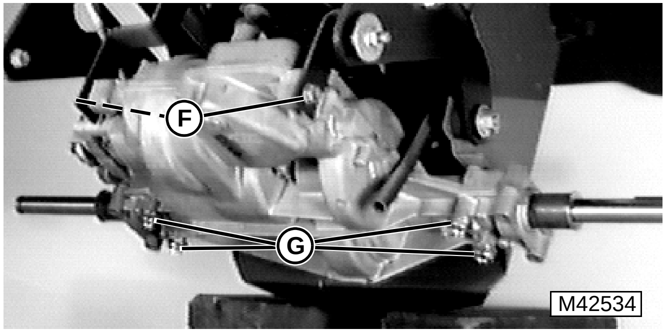
1. Raise and block tractor off surface.
2. Remove drive wheels.



3. Disconnect shift linkage (B) from shift arm (C).
4. Remove traction drive belt (A).



5. Disconnect clutch/brake rod return spring (D).
6. Disconnect clutch/brake rod (E).



7. Support transaxle with jack stands or have a helper hold transaxle in place while you remove hardware.
8. Remove front cap screws (F) and rear hardware (G).
9. Carefully remove transaxle to workbench.
10. Install transaxle in reverse order of removal.
11. Tighten mounting hardware.

Front Hanger cap screws to frame . . . . 27.1—54.2 N•m (240—480 lb-in.)
Front transaxle cap screws to hangers . . . . 21.7—32.5 N•m (192—288 lb-in.)
Rear axle cap screws and nuts to frame . . . . 20.3—47.4 N•m (180—420 lb-in.)
Shift linkage lock nut . . . . 13.5—17.6 N•m (120—156 lb-in.)

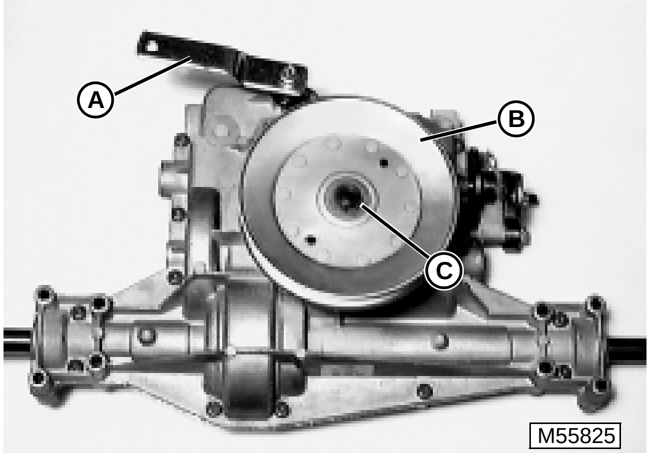
NOTE: Replacement transaxle will not have tapped holes for front hanger brackets. Reuse original self tapping cap screws and torque to 32.5 N•m (288 lb-in.).

12. Install traction drive belt (C).
13. Install drive wheels.
14. Lower tractor to surface.

TRANSAXLE—DISASSEMBLY STX38 (SN 210001—) & STX46

IMPORTANT: Pay close attention to the order and orientation of all components to their neighbor components. Mark them, if necessary. This will help greatly when its assembly time.

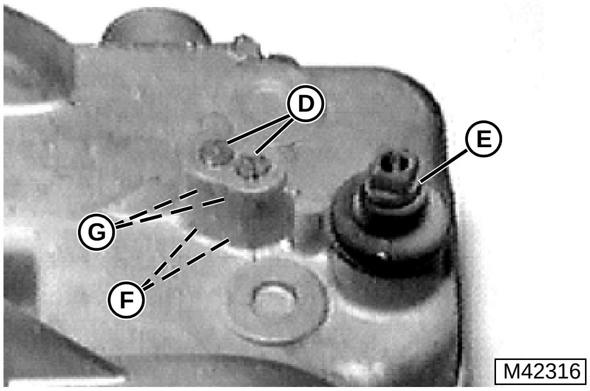
Remove Drive Sheave/Shift Arm:



1. Remove drive sheave snap ring (C).
2. Remove drive sheave (B).
3. Remove shift arm (A). Be sure when installing that special square hole washer and shift arm are seated properly over square end of shifter shaft.

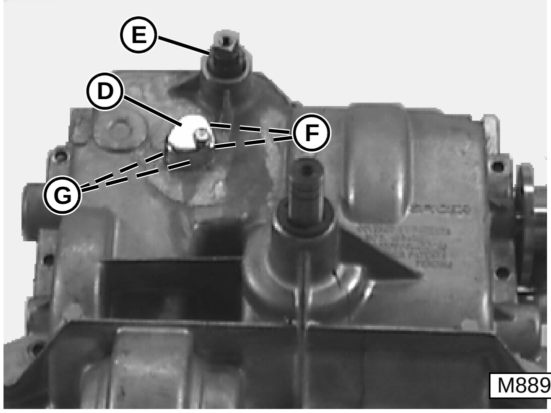
Remove Shifter Detent Assembly

STX38 (SN 210001—301382) and STX46 Transaxle



1. Remove shifter shaft rubber boot (E).
2. Remove both set screws (D) and detent springs (G).

STX38 (SN 301383—) Transaxle

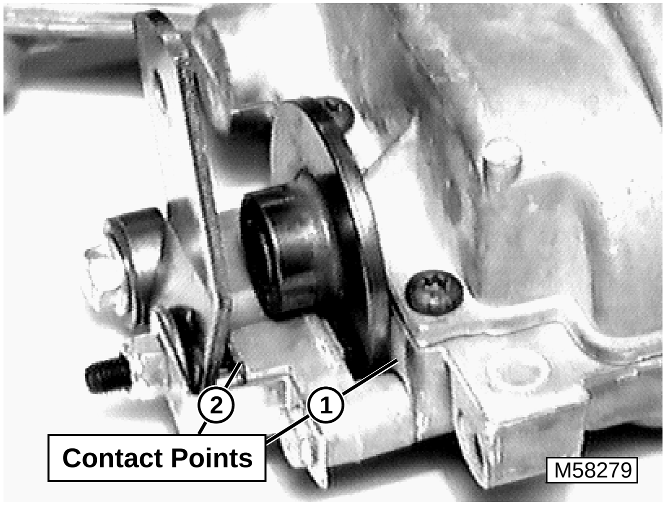


1. Remove shifter shaft rubber boot (E).
2. Remove detent cover (D) and detent springs (G).

IMPORTANT: DO NOT drop or lose detent balls.

3. Use a magnet or place a shop cloth over holes and turn transaxle upside-down to catch both detent balls (F) in cloth.
4. Inspect detent balls and springs for wear or damage. Replace components as necessary, but do not install until assembly, much later in this section.

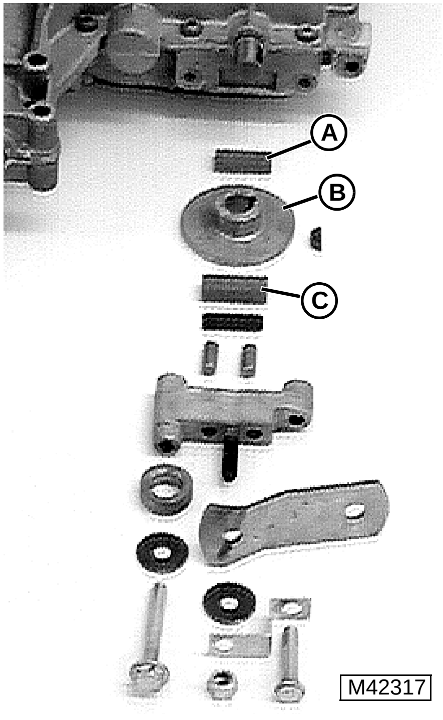
Remove Brake Assembly:



IMPORTANT: First check brake components for wear. Check for brake disc contacting the case (1) and/or brake lever contacting its mounting bracket (2), top or bottom. If so, all three components must be replaced.

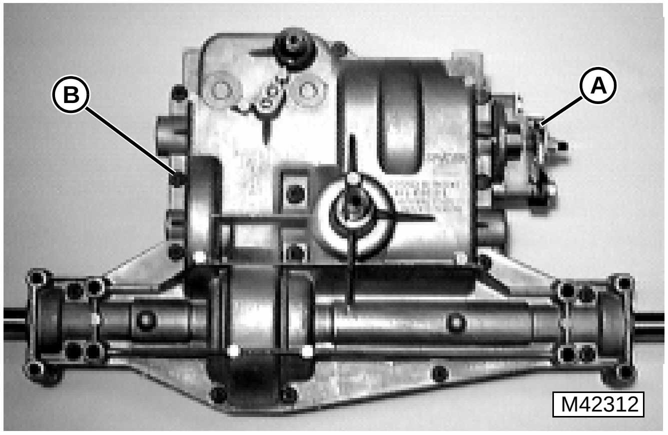
NOTE: STX38 (SN 210001—301382) and STX46 brake assembly is depicted below. STX38 (SN 301383—) brake assembly differs slightly, but main components remain the same.

1. Remove brake assembly.

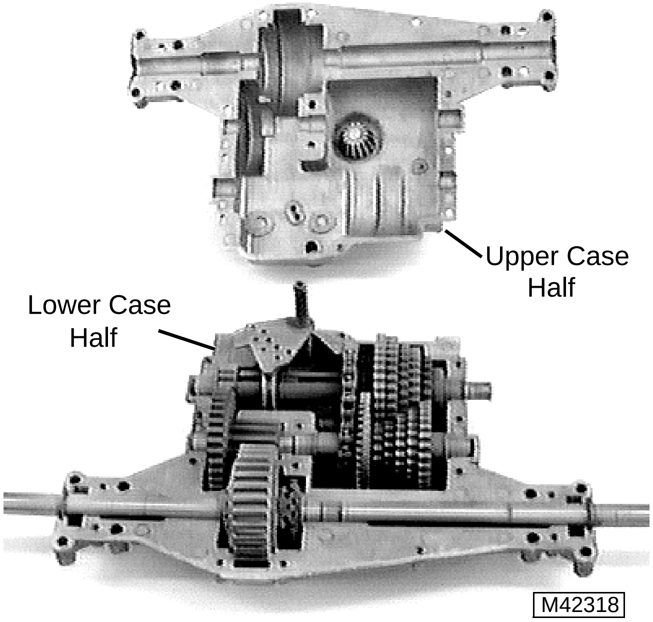


2. It is recommended that thinner, inside, (A) and thicker, outside, (C) friction pucks and brake disc (B) be replaced (pucks ordered as set only) anytime transaxle is disassembled.
3. Inspect remaining components for wear or damage. Replace components as necessary, but do not install this assembly until transaxle has been completely assembled.

Separate Transaxle Housing Case Halves:

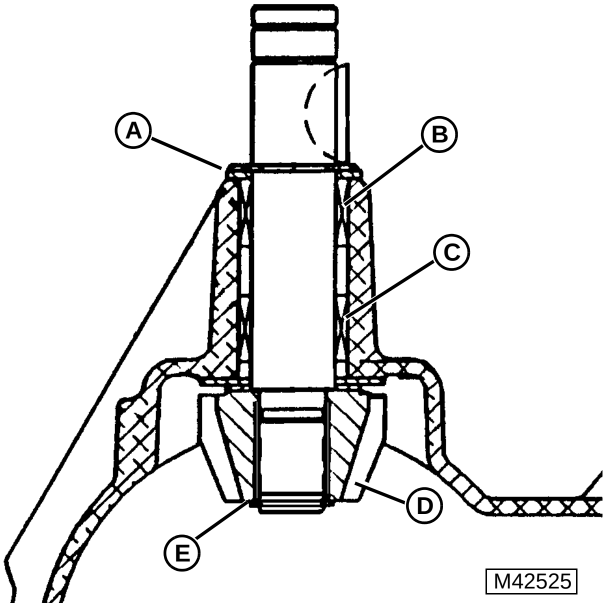


1. Remove all sixteen transaxle housing socket head screws (B)—brake assembly (A) should be removed already, see previous procedure.



2. **C**arefully separate transaxle housing into upper and lower case halves.
3. Inspect overall condition of components without removing any of them. Visually target worn or damaged parts for replacement.
4. Remove most of the grease without removing any components.

Inspect Input Shaft/Pinion Gear Assembly:

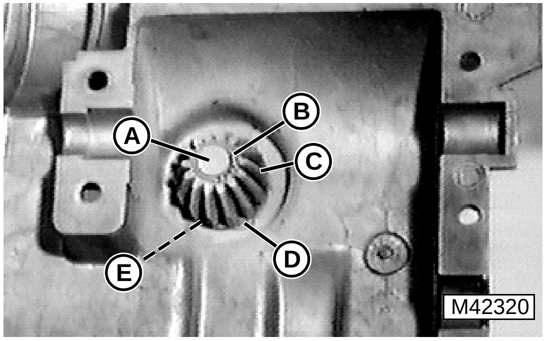


1. Visually check overall condition of assembly, including the key and keyway, and the drive sheave hub keyway as well.
2. Check condition of pinion gear (D)—look for wear, pitting, broken teeth, etc.
3. Grasp the input shaft and try to rock it left or right inside case housing. If movement is noticeable, needle bearings (B and C) inside diameters will need to be measured once shaft is removed.
4. Use a feeler gauge to measure “go/no go” air gap between pinion gear (D) and snap ring (E):

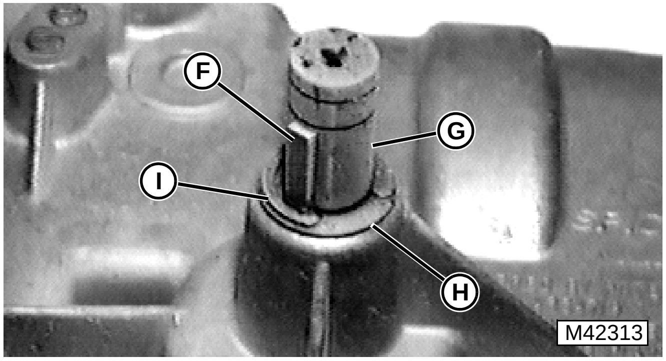
- “GO” air gap should be **0.25 mm (0.010 in.) or less**
- “NO GO” measurement is **anything greater**.

5. If measurement results in a “NO GO” reading, shim thickness (A) needs to be changed or worn components must be replaced.

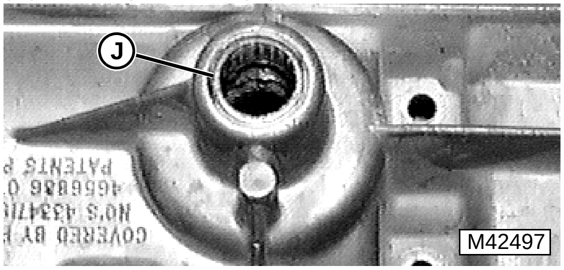
Disassemble Input Shaft/Pinion Gear Assembly:

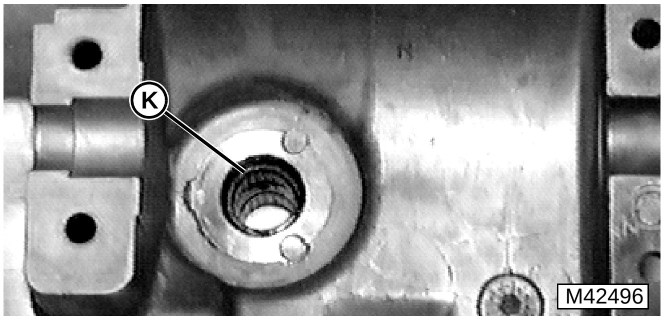


1. Remove snap ring (B), bevel pinion gear (C), small washer (E), and large washer (D) from input shaft (A), inside upper case half.



2. Turn upper case half over.
3. Remove woodruff key (F), E-ring (I), shim washer (H), and input shaft (G).

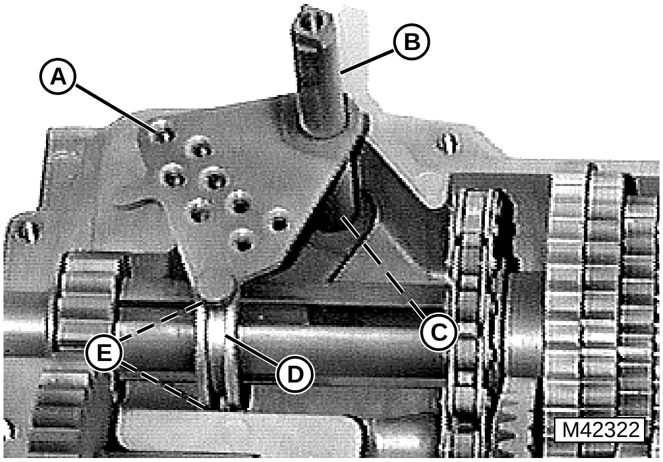




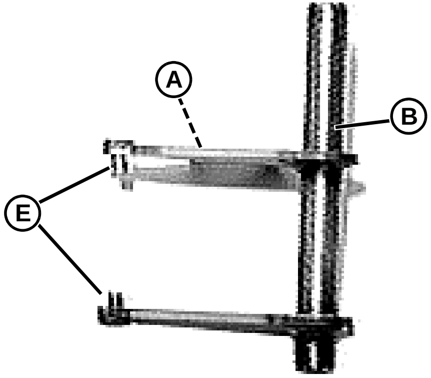
IMPORTANT: DO NOT scratch or deform upper case half bore when removing needle bearings.

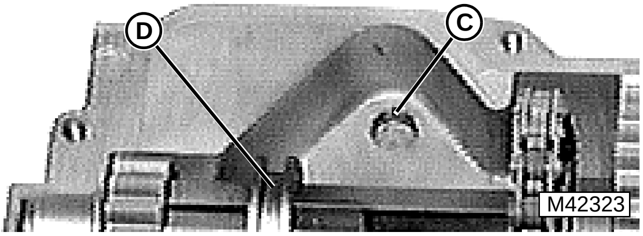
4. Visually inspect condition of upper case half input shaft needle bearings, upper bearing (J) and lower bearing (K).
5. Measure inside diameters of each bearing:
   - "GO" measurement should be **15.89—15.92 mm (0.6255—0.6269 in.)**
   - "NO GO" measurement is **anything greater**.
6. If measurement results in a "NO GO" reading for either bearing, replace both bearings (ordered as set with special grease) by carefully pressing them from case half bore without damaging bore.
7. Clean and inspect bore. If scratched or deformed, replace upper case half.

Disassemble Shifter Shaft Assembly:



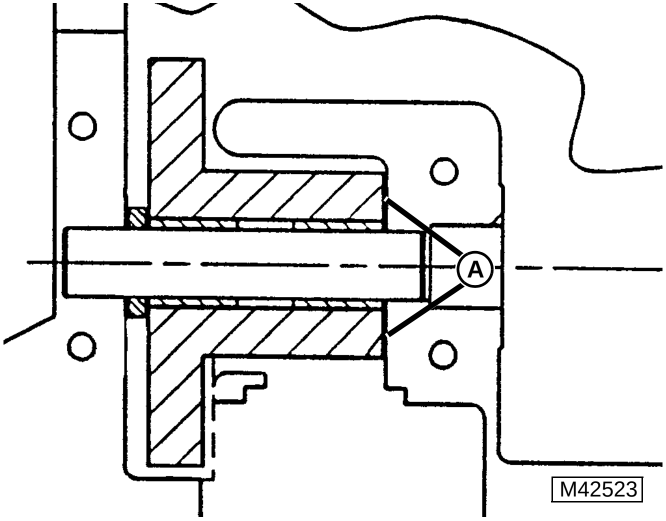
1. Lift shifter shaft assembly (B) from lower case half mounting hole (C) and groove of shift collar (D).





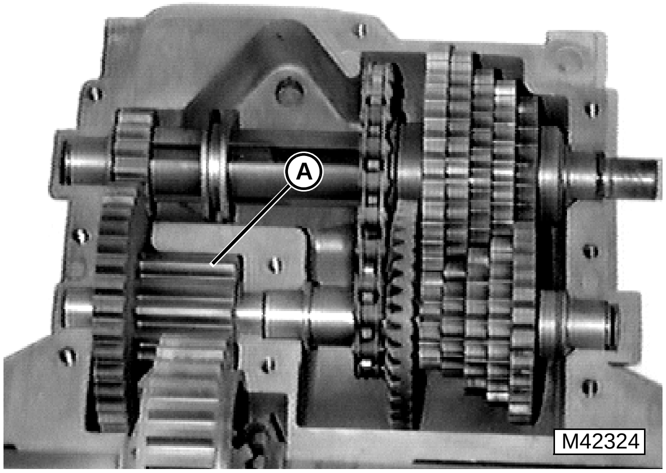
2. Clean shifter shaft assembly once removed.
3. Inspect condition of detent holes (A), shift pins (E), overall shifter shaft assembly (B), lower case half mounting hole (C), and shift collar (D).
4. If any part of shifter shaft assembly (B) is worn or damaged, replace it; also, the rubber boot, and the detent balls, detent springs, and set screws (see Service Kits listing at beginning of section).
5. If lower case half mounting hole (C) is worn or damaged, replace the case half.
6. If shift collar (D) is worn or damaged, replace it when intermediate shaft assembly is disassembled.

Inspect Idler Combination Gear Assembly:



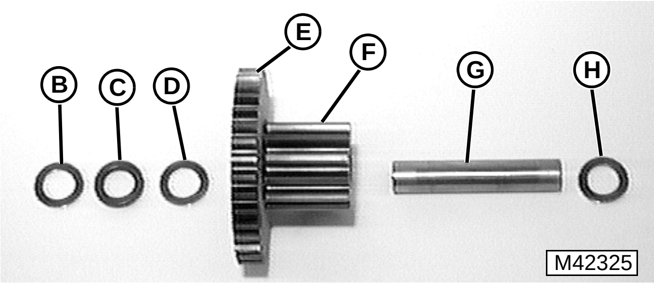
1. Visually check overall condition of assembly, including shaft and bushings, gears for wear, pitting, broken teeth, etc.
2. Use a feeler gauge to measure “go/no go” air gap (A) between end surface of combination gear and side surface of case half:
   - “GO” air gap should be **0.33—0.63 mm (0.013 — 0.025 in.)**
   - “NO GO” air gap is **anything greater**.
3. If measurement results in a “NO GO” reading, worn and damages components need to be replaced.

Disassemble Idler Combination Gear Assembly:

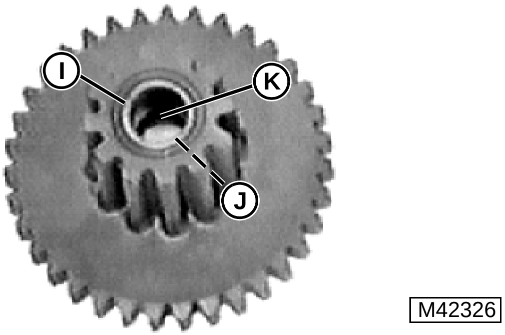


1. Lift idler combination gear assembly (A) from lower case half.
2. Clean components individually once disassembled.

STX38 (SN 210001—301382) and STX46 Transaxle

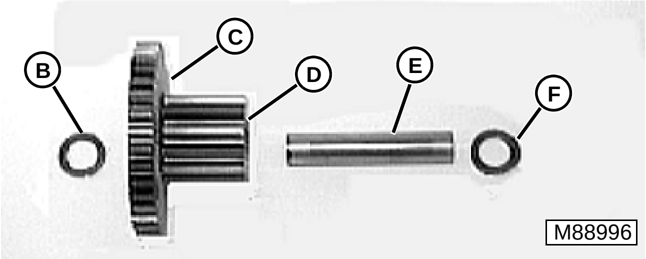


3. Separate and inspect assembly components:
   - washers (B and D) should be 0.632 x 1.00 x 0.026 in., not scored or discolored (burnt)
   - spacer (C) should be 0.630 x 1.00 x 0.169 in., not scored or discolored (burnt)
   - narrow combination gear (E) should have 35 good teeth and wide combination gear (F) should have 12 good teeth, not scored or discolored (burnt)
   - idler shaft (G) should be smooth and not scored, pitted, or discolored (burnt)
   - shim washer(s) (H) are found in Shim Kit.

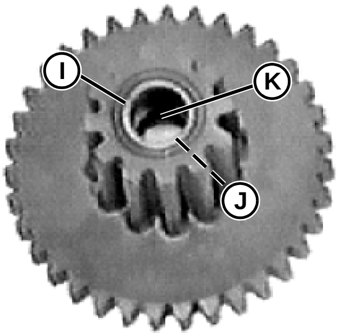


- inside bearing (I) and outside (K), which are press fit, should not be scored nor discolored (burnt);
- gear bore (J) should not be scored or discolored (burnt). Replacement gear has needle bearings (with special grease) and a new shaft is also recommended whenever a new gear is ordered.

STX38 (SN 301383—) Transaxle

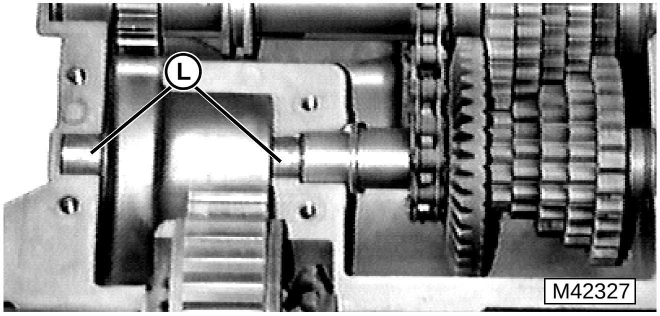


4. Separate and inspect assembly components:
   - washers (B) should be 0.632 x 1.00 x 0.026 in., not scored or discolored (burnt)
   - narrow combination gear (C) should have 30 good teeth and wide combination gear (D) should have 12 good teeth, not scored or discolored (burnt)
   - idler shaft (G) should be smooth and not scored, pitted, or discolored (burnt)
   - shim washer (F) is found in Shim Kit



M42326

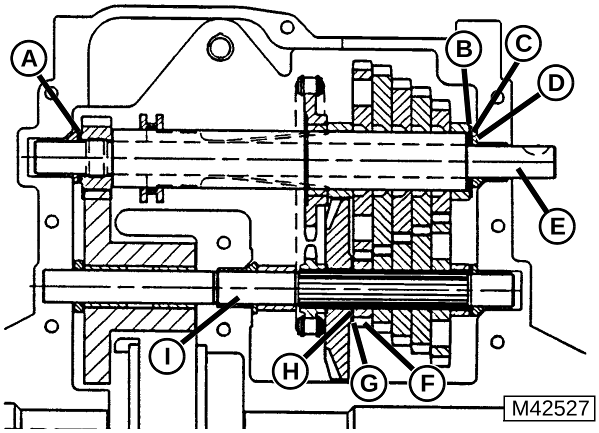
- inside bearing (I) and outside (K), which are press fit, should not be scored nor discolored (burnt)
- gear bore (J) should not be scored or discolored (burnt). Replacement gear has bronze sleeve bearings (2), a new shaft is also recommended whenever a new gear is ordered



M42327

5. Inspect lower and upper case halves idler shaft bearing surfaces (L) for excessive scoring or wear. Replace case halves as necessary.

Inspect Drive/Intermediate Shaft Assemblies:



M42527

1. Visually check overall condition of assemblies, including gears for wear, pitting, broken teeth, etc.
2. For the drive shaft assembly (I), use a feeler gauge to measure "go/no go" air gap (G) between side surface of small gear (F) and side surface of shim washer (H):

- "GO" air gap should be **0—0.20 mm (0—0.008 in.)**
- "NO GO" air gap is **anything greater**.

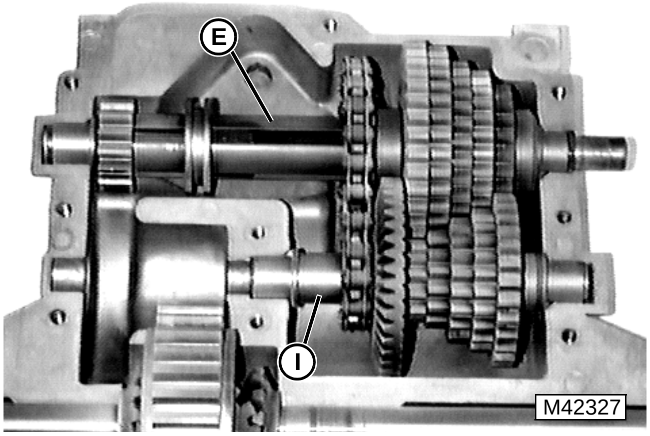
3. For the intermediate shaft assembly (E), use a feeler gauge to measure "go/no go" air gap (C) between end surface of flange bearing (D) and washer (B):

- "GO" air gap should be **0—0.25 mm (0—0.010 in.)**,
- "NO GO" air gap is **anything greater**.

4. If either or both measurements result in a "NO GO" reading, shim washers (A and H) need to be added or worn components need to be replaced.

NOTE: You may prefer to use a caliper to measure the drive shaft gear stack. Remove bevel drive gear only and reinstall rest of drive shaft assembly. Put calliper over shim washer (B) and lip of right-side flange bearing. Caliper should read 61.6077—61.7855 mm (2.4255—2.4325 in.).

Disassemble Drive/Intermediate Shaft Assemblies:

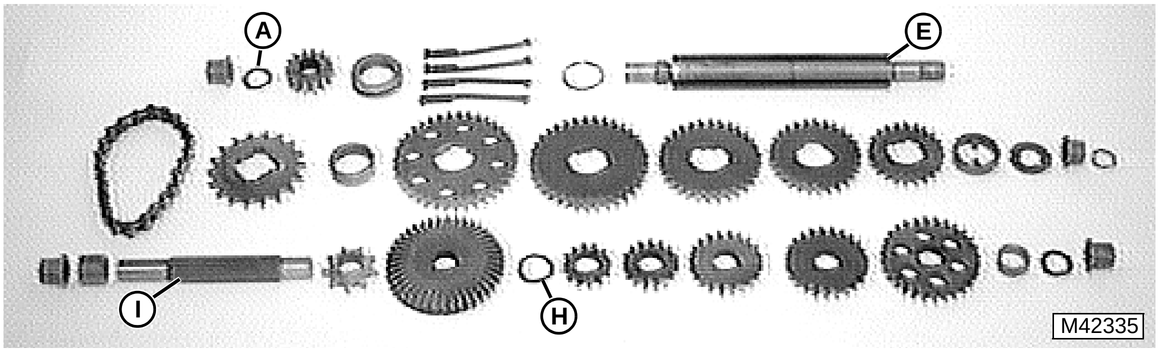


M42327

1. Lift both drive (I) and intermediate (E) shaft assemblies out together.
2. Carefully remove drive shaft assembly components (bottom row of exploded view) from drive shaft (I). Be sure to remember each components orientation to its neighbor and to the drive shaft. You may want to mark the same side of each component to help keep the orientation straight.
3. Clean components individually once disassembled.
4. Inspect each component closely for wear, scoring, cracks, chips, and broken teeth or splines.
5. Do the same for the intermediate shaft (E) and its components (top two rows of exploded view).
6. Replace components as necessary.

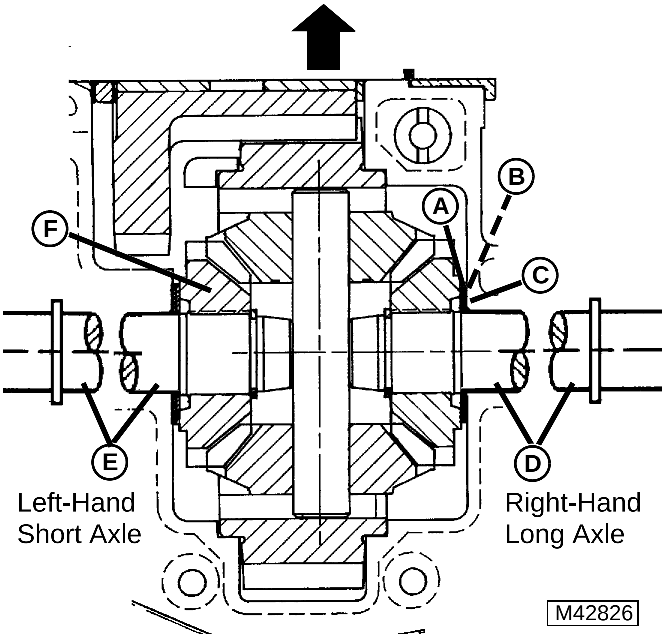
IMPORTANT: Remember gear sets are a matched set and both must be replaced, even if only one gear in the set is damaged. See depiction on opposite page.

—Exploded View—



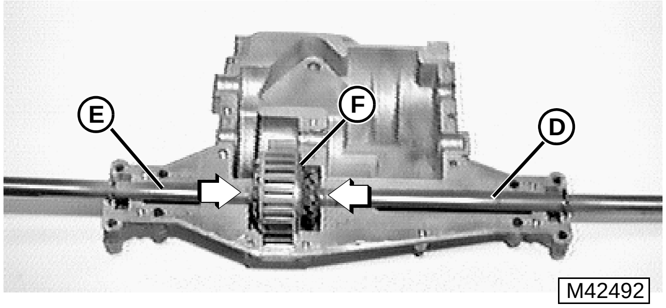
Intermediate and Drive Shaft Components. Shim washers (A) and (H) are found in Shim Kit.

Inspect Differential/Axle Shafts Assembly:

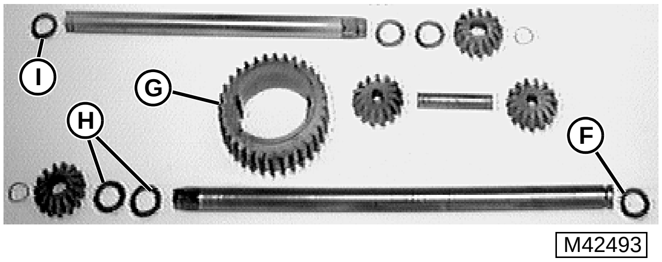


1. Visually check overall condition of assembly.
2. Use a feeler gauge to measure “go/no go” air gap (B) between side surface of shim washer (A) and side surface of lower case (C):
- “GO” air gap should be **0.18—0.36 mm (0.007—0.014 in.)**,
- “NO GO” air gap is **anything greater.**
3. If measurement results in a **“NO GO”** reading, worn or damaged components must be replaced.

Disassemble Differential/Axle Shafts Assembly:



1. Put inward pressure on both axles (D and E) as you lift differential assembly (F) from lower case.



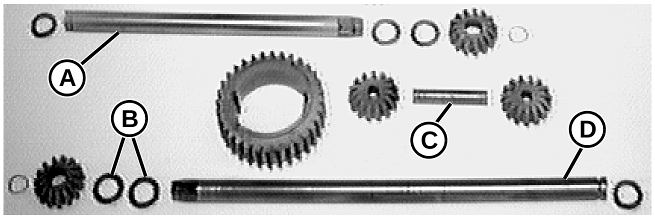
2. Carefully remove axle shaft assembly components from ring gear (G). Be sure to remember each components orientation to its neighbor and to the ring gear (G). You may want to mark the same side of each component to help keep the orientation straight.
3. Clean components individually once disassembled, be sure to remove all sealant material from upper and lower case halves.
4. Inspect each component (especially both upper and lower case halves) closely for wear, scoring, cracks, chips, or discoloration (burnt). Replace components as necessary.
5. Replace seals (I and F) **every time** transaxle housing has been separated.

TRANSAXLE ASSEMBLY— STX38 (SN 210001—) & STX46

NOTE: STX38 (SN 301383—) transaxle differs slightly from STX38 (SN 210001—301382) and STX46 transaxle.

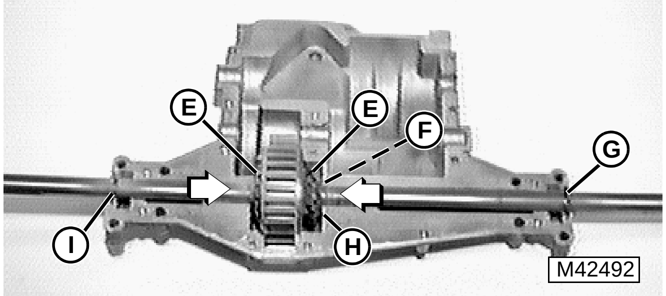
IMPORTANT: Coat lightly all mating surfaces, except seal surfaces, with SAE 30 weight oil before assembly. Pay close attention to proper order and orientation of all components. Also, it is recommended that you use a calliper to ensure the correct shim, spacer, or washers are installed correctly.

Assemble Differential/Axle Shafts Assembly:



M42493

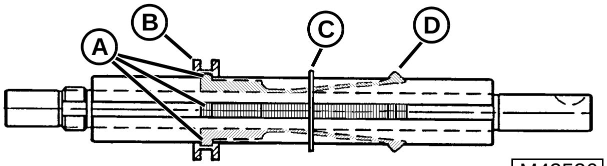
1. Assemble left-hand, short axle (A) as shown with splined, beveled gear facing the ring gear.
2. Assemble right-hand, long axle (D) as shown with splined, beveled gear facing the ring gear and shim washers (B) assembled in combination of thicknesses to obtain specified air gap (see Inspect Differential/Axle Shafts Assembly).
3. Assemble internal shaft (C) as shown with beveled gears facing each other.
4. Install internal shaft assembly in slots of ring gear and push beveled gears away from each other so they are ready to mesh with both axle beveled gears.



M42492

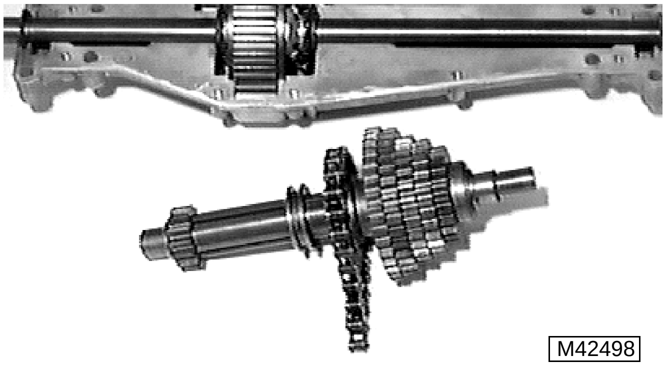
5. Install axle shafts so beveled gears (E) mesh with differential internal shaft beveled gears.
6. Keep inward pressure on both axles as you install differential assembly in lower case housing.
7. Measure air gap between shim washers (F) and side of housing (H). If air gap meets specification (see Inspect Differential/Axle Shafts Assembly), go to next step. If air gap does not meet specification, remove right axle shaft and add other shim washer combinations until air gap in within specification.
8. Carefully install new axle shaft seals (G and I) and seat them in their lower case housing grooves.

Assemble Drive/Intermediate Shaft Assemblies:



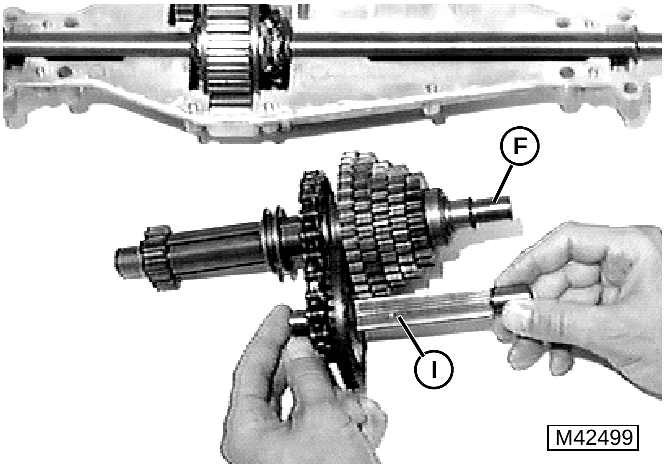
M42526

1. Install retaining ring (C) in intermediate shaft groove.
2. Install four keys in grooves of intermediate shaft and hold them so internal shift collar anchors (A) will seat in internal groove of collar (B) as it is installed on the shaft.
3. Slide shift collar and keys against retaining ring (C) and compress locking ramps/lugs (D) to clear retaining ring.



M42498

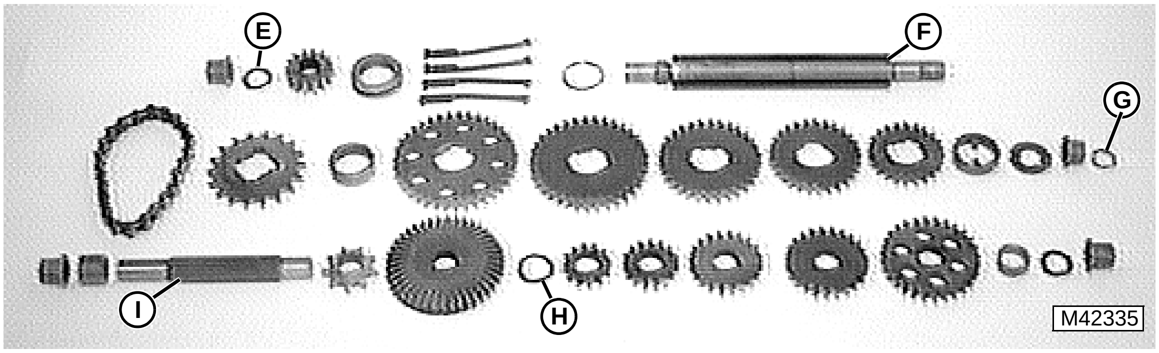
4. Install remaining intermediate shaft components in their proper order and orientation (reference top two rows of components in photo on opposite page).

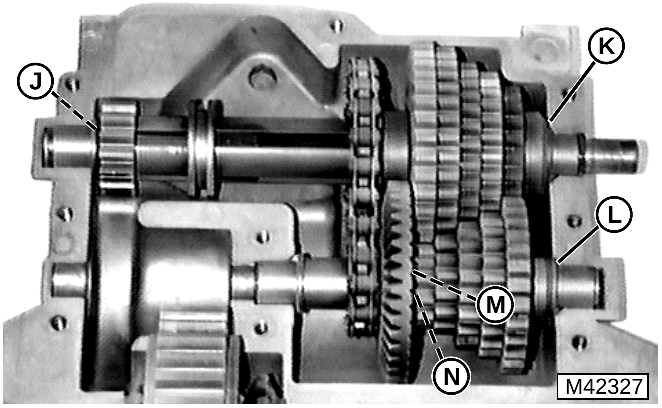


M42499

5. Install drive shaft components one at a time from left-to-right (reference bottom row of components in photo on opposite page). Long flange of small sprocket (J) faces bevel drive gear.
6. Shim washer(s) (E) for intermediate shaft (F) are found in Shim Kit.
7. Shim washer(s) (H) for drive shaft (I) are found in Shim Kit.
8. Install new intermediate shaft seal (G) with open lip facing inside.

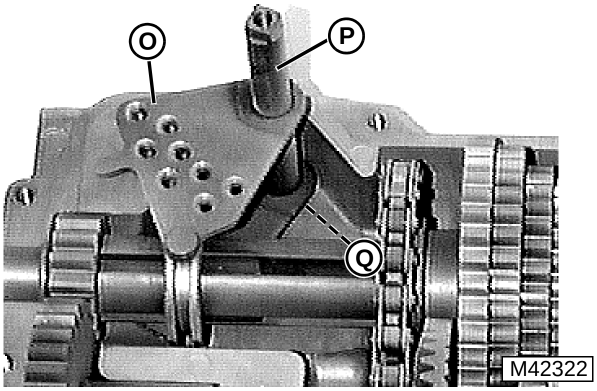
—Exploded View of Intermediate and Drive Shaft Components—





9. Measure air gaps (K and N)—(see Inspect Drive/ Intermediate Shaft Assemblies). Make any changes in shim washer (M) and (J) thicknesses from Shim Kit to obtain proper air gaps.
10. When proper air gap is obtained, gears should drag slightly against feeler gauge.

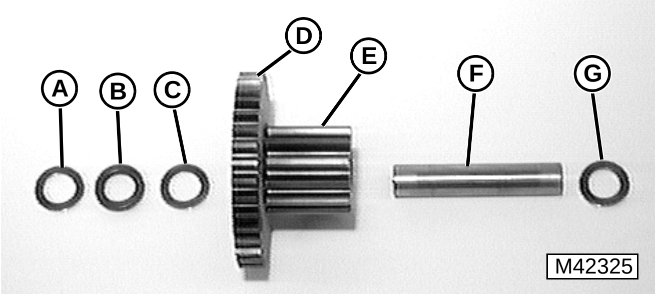
NOTE: *You may prefer to use a caliper to measure the drive shaft gear stack. Remove bevel drive gear only and reinstall rest of drive shaft assembly. Put calliper over shim washer (M) and lip of right-side flange bearing (L). Caliper should read 61.6077—61.7855 mm (2.4255—2.4325 in.).*



11. Apply John Deere Never-Seez® to top surface (O) of shifter plate and contact portions of shifter shaft (P) and (Q) with upper and lower case halves.
12. Install shifter fork assembly.

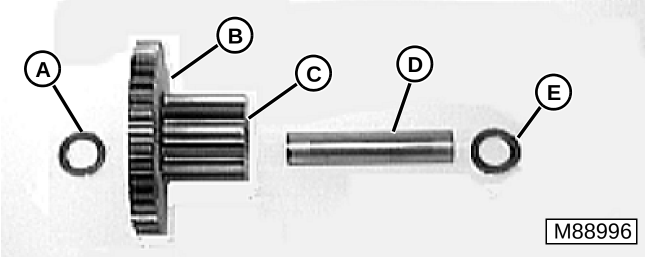
Assemble Idler Combination Gear Assembly

STX38 (SN 210001—301382) and STX46 Transaxle:

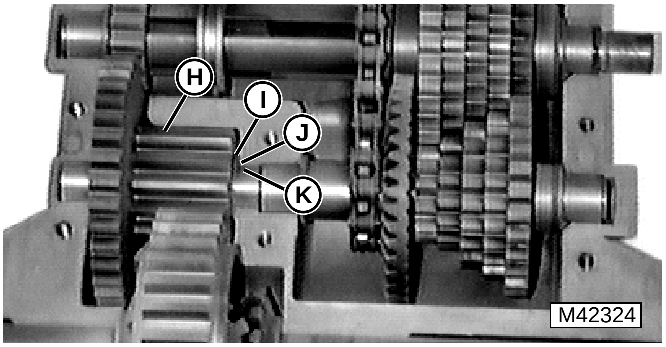


1. Install components on idler shaft in order shown:
   - washers (A and C) should be 0.632 x 1.00 x 0.026 in.
   - spacer (B) should be 0.630 x 1.00 x 0.169 in.
   - narrow combination gear (D) should have 35 good teeth and wide combination gear (E) should have 12 good teeth
   - idler shaft (F) should be smooth, not scored, worn, or pitted
   - shim washer(s) (G) are found in Shim Kit

STX38 (SN 301383—) Transaxle

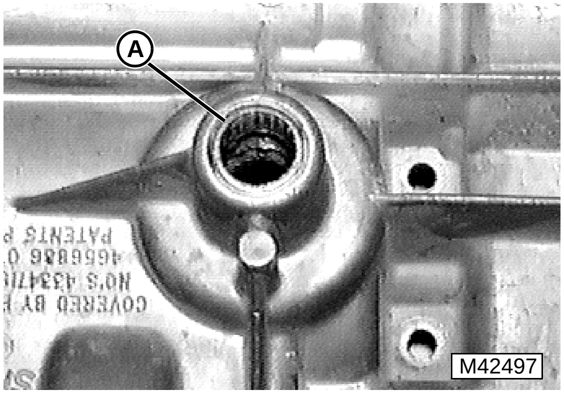


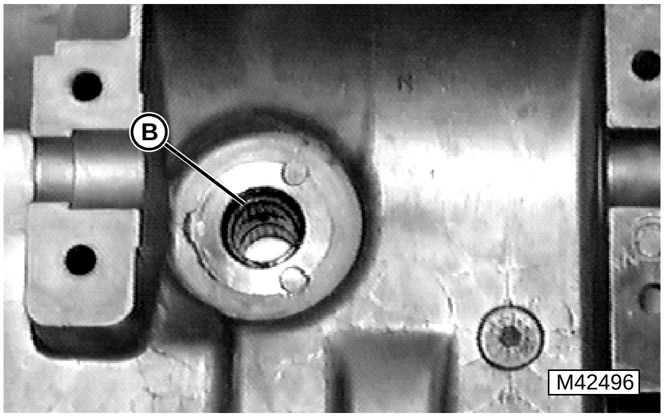
2. Separate and inspect assembly components:
   - washers (A and E) should be 0.632 x 1.00 x 0.026 in., not scored or discolored (burnt)
   - narrow combination gear (B) should have 30 good teeth and wide combination gear (C) should have 12 good teeth, not scored or discolored (burnt)
   - idler shaft (D) should be smooth and not scored, pitted, or discolored (burnt)
   - shim washer (F) is found in Shim Kit

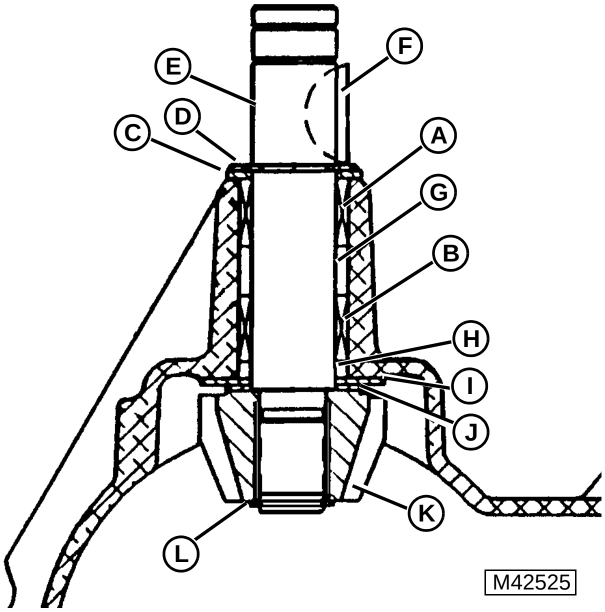


3. Install idler combination gear assembly (H) into lower case half.
4. Measure air gap (J) between shim washer (I) and face of case (K) (see Inspect Idler Combination Gear Assembly).
5. When proper air gap is obtained, assembly should drag slightly against feeler gauge.

Assemble Input Shaft/Pinion Gear Assembly:

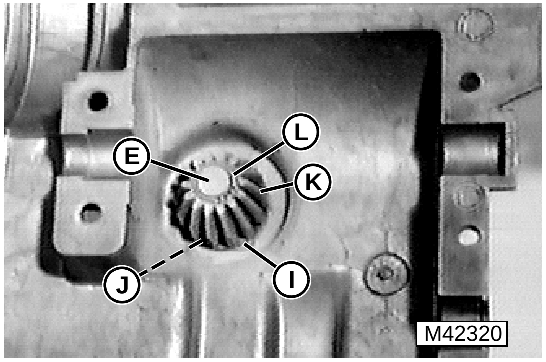




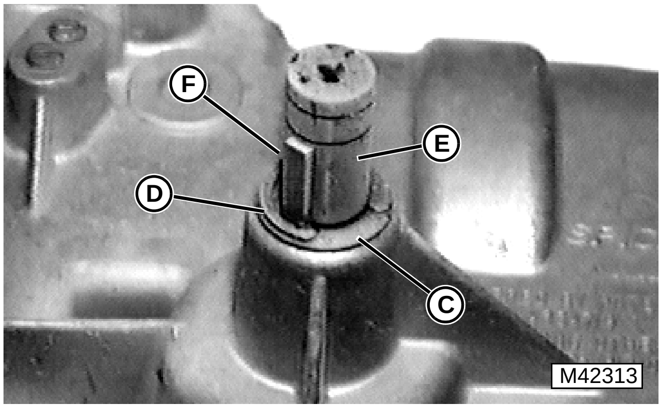


IMPORTANT: DO NOT scratch or deform upper case half bore when installing needle bearings.

1. Pack needle bearings (A and B) with grease before installing.
2. Install lower needle bearing (B) with flat side of bearing (with lettering) toward inside of case. Press lower needle bearing in case bore until it is recessed 3.3 mm (0.13 in.) (H) from inside bore opening.
3. Install upper needle bearing (A) with flat side of bearing (with lettering) toward outside of case. Press upper bearing in case bore until it is flush—0.76 mm recessed (flush—0.03 in. recessed) with outside bore opening.
4. Pack cavities (G and H) with grease before installing input shaft.

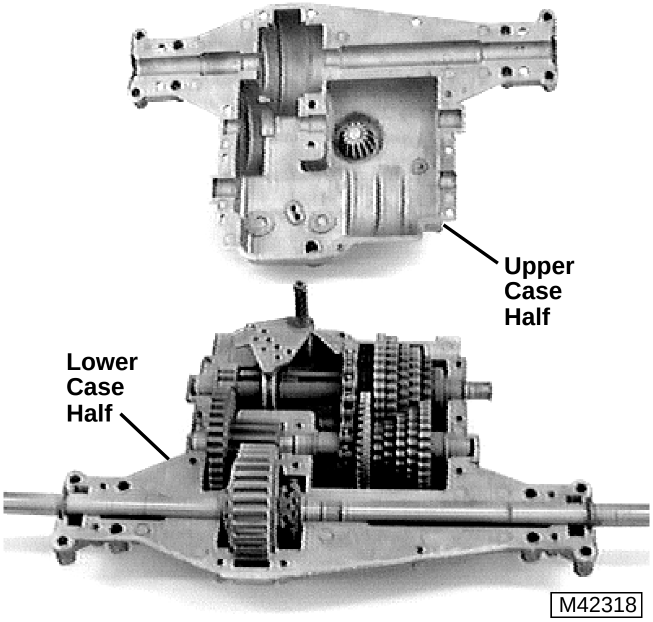


5. Install input shaft (E) (with keyway on outside of case), large washer (I), small washer (J), bevel pinion gear (K), and snap ring (L).



6. Turn upper case half over.
7. Install a shim washer (C) (from Shim Kit) of the proper thickness that allows enough clearance for E-ring (D) to be installed. “GO” air gap should be 0.25 mm (0.010 in.) or less.
8. Turn upper case half over and measure air gap between snap ring (L) and bevel pinion gear (K) (see Inspect Input Shaft/Pinion Gear Assembly).
9. If measurement results in a “NO GO” reading, shim thickness (C) needs to be changed.
10. Install woodruff key (F) in shaft keyway.

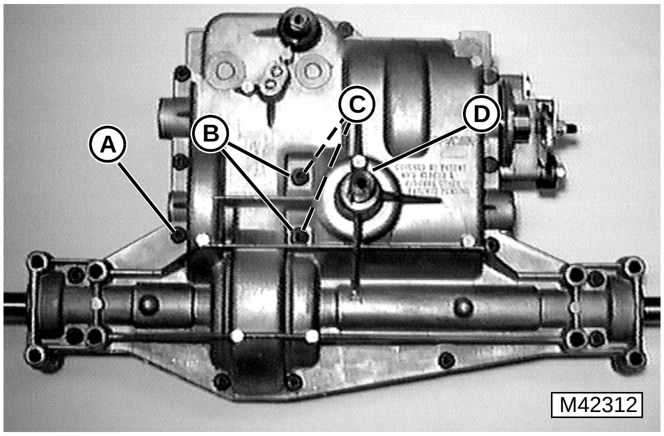
Assembly Transaxle Housing Case Halves:



1. Pack upper case beveled pinion gear and lower case housing assembly with 638 g (1.406 lbs) of grease.

IMPORTANT: BE SURE sealant DOES NOT contact any gear, shaft, or bearing surfaces.

2. Apply John Deere Form-In-Place Gasket Silicone Sealant to case cutouts where intermediate shaft flange bearing sets into upper and lower case halves.



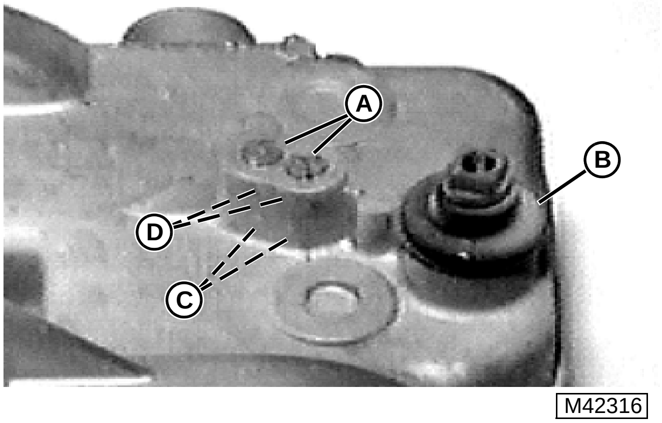
3. Align lower and upper case halves together, **be sure** shaft seals are seated correctly and you may have to turn input shaft (D) slightly to insure beveled pinon gear meshes with beveled drive gear.
4. Install 14 outside socket head screws (A) and two center socket head screws (B) with new rubber seals (C).
5. Tighten screws to specification.

Specification:

Transaxle Cap Screws
. 9—10 N•m (100—125 lb-in.)

Install Shifter Detent Assembly

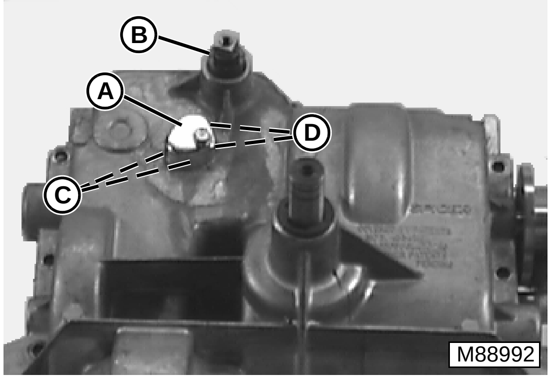
STX38 (SN 210001—301382) and STX46 Transaxle



IMPORTANT: DO NOT drop or lose detent balls.

1. Install shifter shaft rubber boot (B).
2. Coat detent balls (C) and springs (D) with John Deere Never-Seez and install in case bores.
3. Install and tighten set screws (A) until they are flush with top of mounting hole surface.

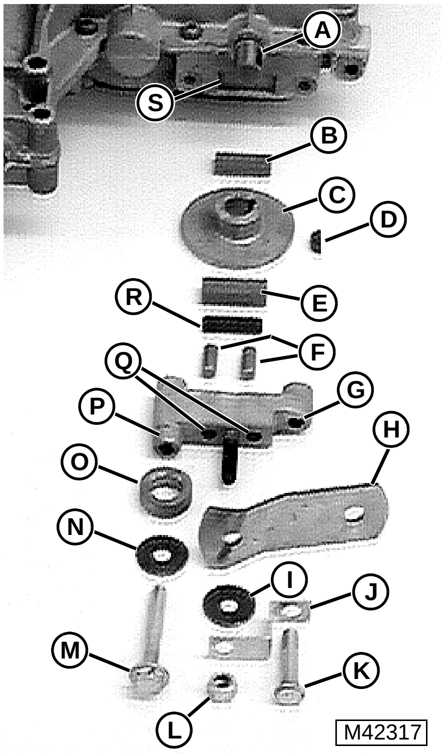
STX38 (SN 301383—) Transaxle



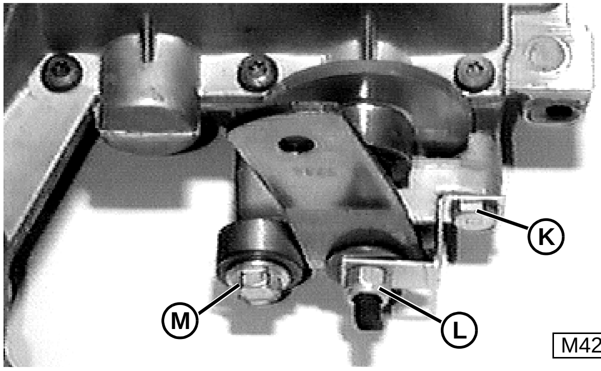
1. Install shifter shaft rubber boot (B).
2. Coat detent balls (C) and springs (D) with John Deere Never-Seez and install in case bores.
3. Install and tighten detent cover (A) and screw until they are flush with top of mounting hole surface.

BRAKES—ASSEMBLY

IMPORTANT: STX38 (SN 301383—) brake assembly differs from depiction, components remain the same.



1. Install woodruff key (D) into shaft keyway (A).
2. Install thinner friction puck (B) in lower case puck recess (S).
3. Install brake disc (C) with hub outward.
4. Install spacer (O) over left lip (P) of mounting bracket.
5. Install long cap screw (M) and washer (N) in left mounting bracket hole.
6. Install brake lever (H), washer (I), bent bracket (J), and lock nut (L) on mounting bracket center stud.
7. Install short cap screw (K) in right mounting bracket hole (G).
8. Install dowel pins (F) inside two center mounting bracket holes (Q).
9. Install striker plate (R) and thick friction puck (E) in backside recess of mounting bracket.



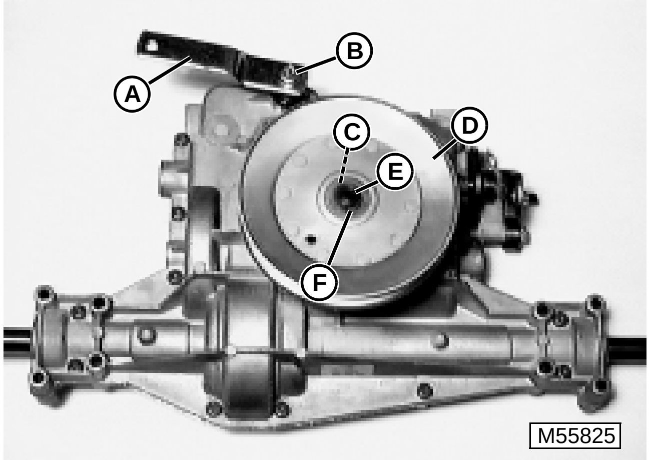
1. Install complete brake assembly to transaxle.
2. Tighten cap screws (K and M) to specification.
3. Tighten lock nut (L) to specification.

Specifications:

Brake Assembly Cap Screws
. . . . 18—22 N•m (160—200 lb-in.)

Brake Assembly Lock Nut
—Tighten Until Required Air Gap Is Reached
. . . . 0.254 mm (0.010 in.) air gap between thick friction puck (outside brake pad) and brake disc (rotor).

Install Drive Sheave and Shift Arm:



1. Install woodruff key (C) in input shaft (E).
2. Install drive sheave (D) and fasten with snap ring (F).
3. Install shift arm (A). Tighten cap screw (B) to specification.

Specification:

Shift Arm Cap Screw
. . . . 13.5—17.6 N•m (120—156 lb-in.)

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Gear Teeth:

Spur Gear (drive shaft)	6 teeth
Differential Ring Gear	98 teeth
Differential Bevel Pinion Gears (cross shaft)	10 teeth
Differential Bevel Pinion Gears (axle shafts)	16 teeth

Drive Belt:

Effective Length	
New	2485 ±8 mm (97.8 ± 0.3 in.)
Minimum	2477 mm (97.5 in.)
Maximum	2530 mm (99.6 in.)
Top Width	
New	13.11 mm (0.52 in.)
Minimum	10 mm (0.39 in.)
Bottom Width	
New	7.93 mm (0.31 in.)
Minimum	6 mm (0.24 in.)
Depth	
New	9.46 mm (0.37 in.)
Minimum	7 mm (0.28 in.)

Lubrication:

Oil Type	10W30 Engine Oil, Class CD
Capacity	1.6 L (1.7 qt)

Gear Ratios:

Forward	25.3:1
Reverse	25.3:1

Ground Speeds:

Domestic—Forward	0–8.66 km/hr (0–5.38 mph)
Reverse	0–4.24 km/hr (0–2.62 mph)
Export—Forward	0–7.75 km/hr (0–4.82 mph)
Reverse	0–3.80 km/hr (0–2.36 mph)

Output Torque Rating:

Rated	196 N•m (145 lb-ft)
Maximum	680 N•m (506 lb-ft)

Brake Torque Rating:

Maximum	196 N•m (145 lb-ft) at 245 N (55 lbs) Brake Arm Force

Rear Axle Loading:

Maximum	240 kgs (528 lbs)

REPAIR SPECIFICATIONS

Transaxle Components Wear Tolerances:

Pump (Input) Shaft	
Wear Limit	Visual Check
Motor (Drive) Shaft	
Wear Limit	Visual Check
Axle Shaft Thrust Washers	
Wear Limit	Visual Check
Pump Plate	
Wear Limit	Visual Check
Motor Plate	
Wear Limit	Visual Check
Pump Swashplate Upper Case Thrust Bushings	
Minimum	1.3 mm (0.051 in.)
Pump Swashplate Bushing	
Wear Limit	Visual Check
Pump Swashplate-To- Shifter Blocks	
Maximum	0.15 mm (0.0059 in.)
Axle Shaft-To-Upper Case Bushing	
Maximum	0.5 mm (0.02 in.)
Differential Cross-Shaft-To-Bevel Pinion Gears	
Maximum	0.5 mm (0.02 in.)

Brake Components Wear Tolerances:

Brake Disc (Minimum)	2.5 mm (0.1 in.)
Brake Puck (Minimum)	8 mm (0.32 in.)
Brake Lever (Minimum)	25 mm (1 in.)
Brake Lever Forward Angle (Maximum	30°

TORQUE SPECIFICATIONS (ALPHABETICAL ORDER)

Brake Lever Bracket Cap Screws	44—59 N•m (390—521 lb-in.)
Case Cap Screws	
New Case	27—31 N•m (243—278 lb-in.)
Used Case	23—27 N•m (200—243 lb-in.)
Center Block Cap Screws	44—59 N•m (390—521 lb-in.)
Drain Plug	15—19 N•m (132—168 lb-in.)
Pump Port Connector	20—24 N•m (174—217 lb-in.)
Pump Port Connector Pipe Plug	8 N•m (72 lb-in.)
Pump Port Plug	20—24 N•m (174—217 lb-in.)
Reservoir Cover Cap Screws	22—29 N•m (200—260 lb-in.)

OTHER MATERIALS

Transaxle Housing Case Half Sealant:

. . . . .John Deere Form-In-Place Silicone Gasket Sealant

Pump Connector Pipe Plug Sealant:

. . . . .John Deere Pipe Sealant With Teflon®
Approved Teflon® Sealant Tape. . . . . .Standard Roll

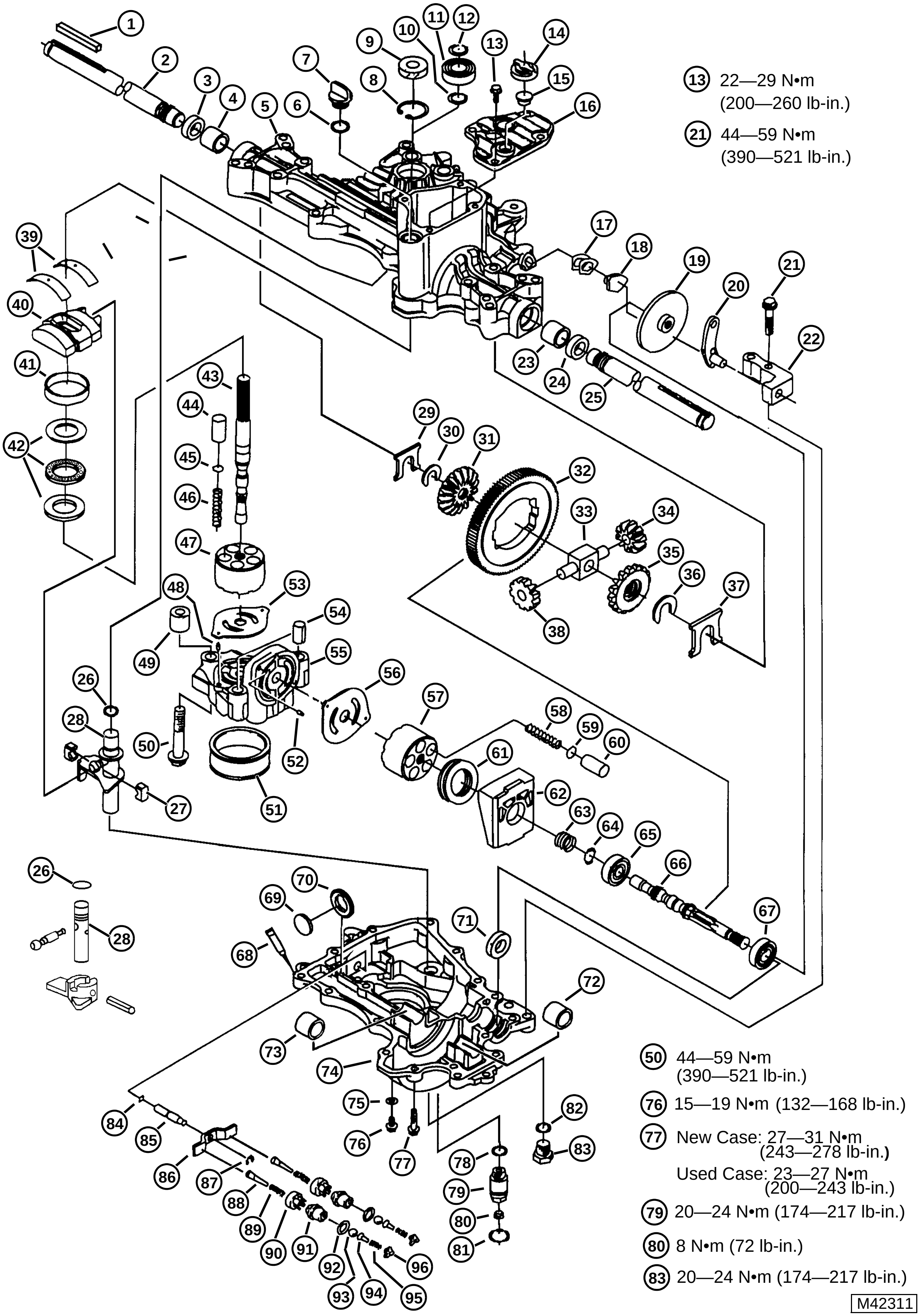
Lubrication:

Type . . . . John Deere Plus-4 10-W-30 Class-CD
Capacity . . . . 1.6 L (1.7 U.S. qt)

COMPONENT LOCATION

1. Axle Shaft/Wheel Key (2 used)
2. Left Axle Shaft
3. Left Axle Shaft Seal
4. Left Axle Shaft Bushing
5. Upper Case Housing
6. O-Ring
7. Fill Cap
8. Snap Ring
9. Input Shaft Seal
10. Snap Ring
11. Ball Bearing
12. Snap Ring
13. Cap Screw (M8x20) (4 used)
14. Vent Valve Cap
15. Vent Valve
16. Reservoir Cover
17. Brake Friction Puck Shims
18. Brake Friction Puck
19. Brake Disc (splined)
20. Brake Lever
21. Cap Screw (M10x45) (2 used)
22. Brake Lever Mounting Bracket
23. Right Axle Shaft Bushing
24. Right Axle Shaft Seal
25. Right Axle Shaft
26. Shifter Shaft O-Ring
27. Shift Block (2 used)
28. Shifter Shaft
29. Left Axle Shaft Thrust Washer
30. Left Axle Shaft C-Ring Retainer
31. Left Axle Shaft Differential Bevel Pinion Gear (16 teeth)
32. Differential Ring Gear (98 teeth)
33. Differential Cross Shaft Block
34. Differential Cross Shaft Bevel Gear (10 teeth)
35. Right Axle Shaft Differential Bevel Pinion Gear (16 teeth)
36. Right Axle Shaft C-Ring Retainer
37. Right Axle Shaft Thrust Washer
38. Differential Cross Shaft Bevel Gear (10 teeth)
39. Pump Swashplate Upper Case Thrust Bushing (2 used)
40. Pump Swashplate
41. Pump Swashplate Bushing
42. Pump Swashplate Bearing
43. Pump Input Shaft
44. Pump Piston (5 used)
45. Pump Piston Washer (5 used)
46. Pump Piston Spring (5 used)
47. Pump Cylinder Block
48. Pump Plate Dowel Pin (2 used)
49. Spacer (M10x20x20)
50. Cap Screw (M10x60) (3 used)
51. Pump Filter
52. Motor Plate Dowel Pin (2 used)
53. Pump Plate
54. Rolled Pins (M12x22) (2 used)
55. Pump and Motor Center Block
56. Motor Plate
57. Motor Cylinder Block
58. Motor Piston Spring (5 used)
59. Motor Piston Washer (5 used)
60. Motor Piston (5 used)
61. Motor Swashplate Bearing
62. Motor Fixed Swashplate Housing
63. Spring
64. Snap Ring
65. Ball Bearing
66. Motor Output Shaft (6 teeth)
67. Ball Bearing
68. John Deere Silicone Sealant (TY15130 or TY15443)
69. Debris Magnet
70. Magnet Seal
71. Motor Output Shaft Seal
72. RH Axle Bushing
73. LH Axle Bushing
74. Lower Case Housing
75. O-Ring
76. Drain Plug
77. Cap Screw (Self-Tapping) (M8x30) (17 used)
78. O-Ring
79. Bleed Port Connector
80. Pipe Plug
81. O-Ring
82. O-Ring
83. Pump Port Plug
84. O-Ring
85. Transport Bypass Valve Actuating Pin
86. Transport Bypass Valve Actuating Bracket
87. E-Ring
88. Transport Bypass Valve Push Pin (2 used)
89. Transport Bypass Valve Spring (2 used)
90. Transport Bypass Valve Push Pin Guide (2 used)
91. Transport Bypass Valve Body (2 used)
92. O-Ring (2 used)
93. Ball (2 used)
94. Ball Holder (2 used)
95. Spring (2 used)
96. Spring Holder (2 used)

HYDROSTATIC TRANSAXLE



⑬ 22—29 N•m
(200—260 lb-in.)

㉑ 44—59 N•m
(390—521 lb-in.)

㊿ 44—59 N•m
(390—521 lb-in.)

(76) 15—19 N•m (132—168 lb-in.)

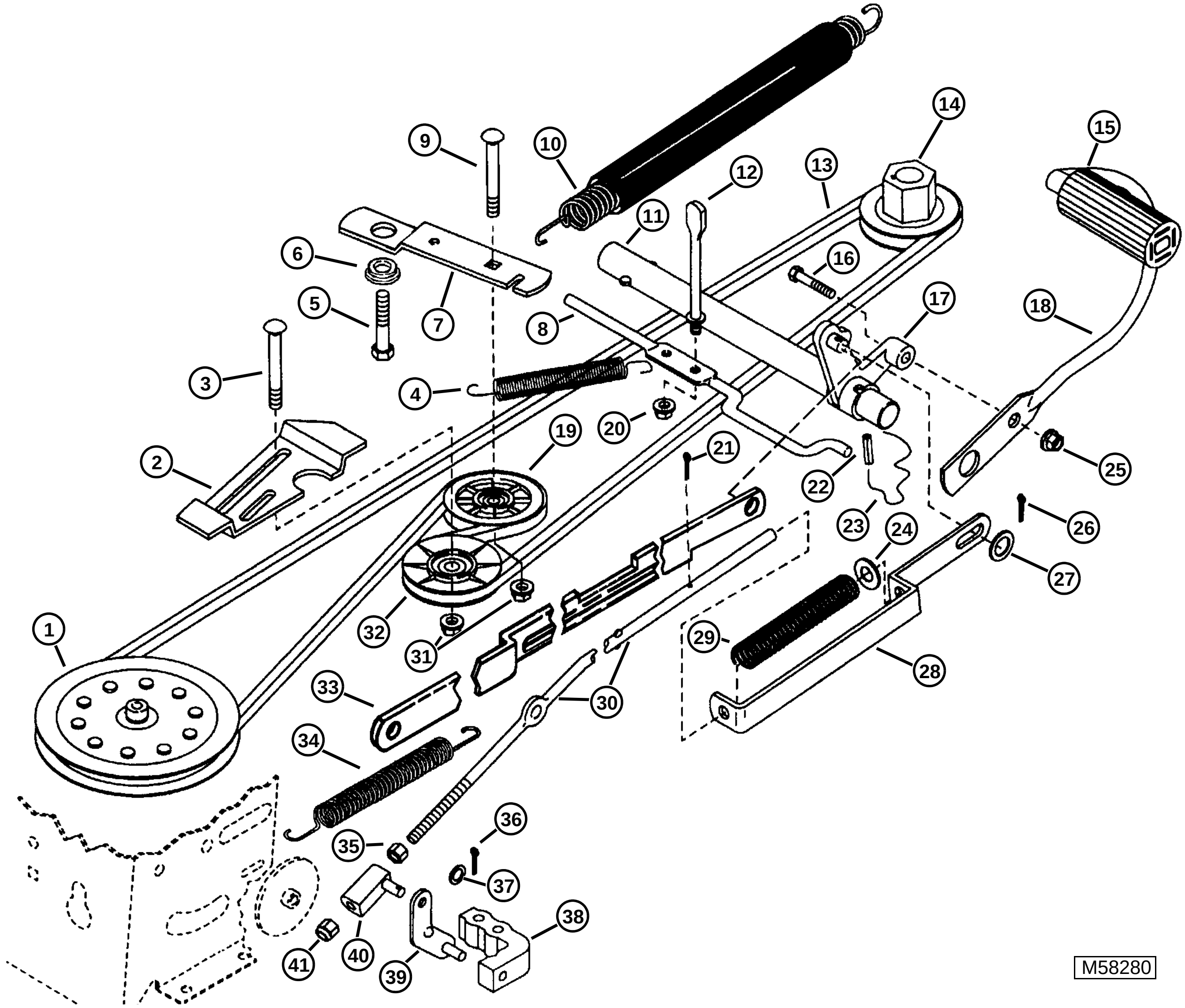
(77) New Case: 27—31 N•m
(243—278 lb-in.)
Used Case: 23—27 N•m
(200—243 lb-in.)

(79) 20—24 N•m (174—217 lb-in.)

(80) 8 N•m (72 lb-in.)

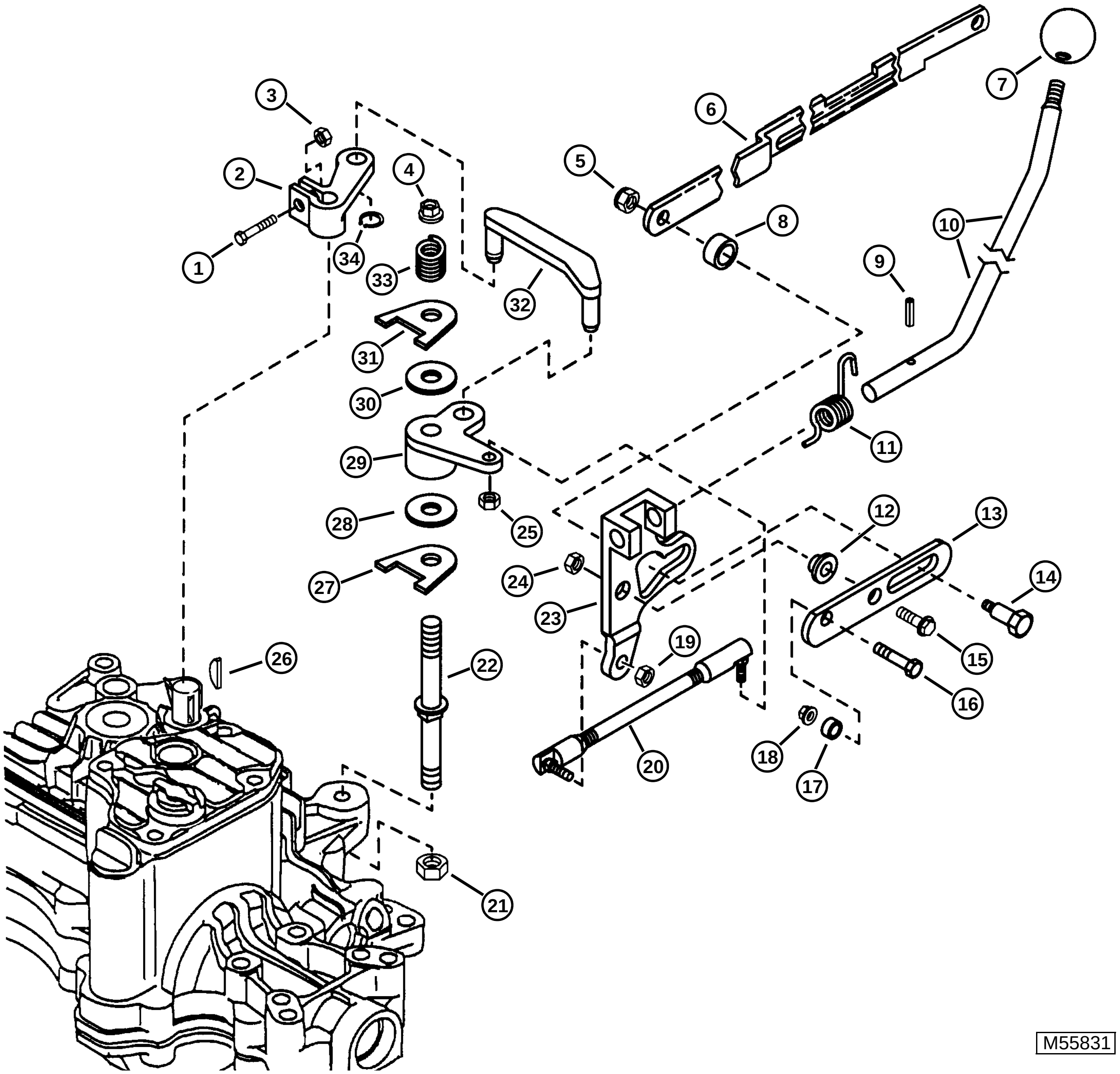
(83) 20—24 N•m (174—217 lb-in.)

TRACTION DRIVE SYSTEM COMPONENT LOCATION



1. Transaxle drive sheave
2. Frame weldment—idler adjustment
3. Carriage bolt (M8x35)
4. Park locking rod tension spring
5. Cap screw (M8x20)
6. Bushing
7. Tensioning strap
8. Park locking rod
9. Carriage bolt (M8x45)
10. Tensioning spring (with anti-vibration hose – early models only)
11. Brake shaft
12. Park lever
13. Drive belt
14. Crankshaft drive sheave
15. Foot pad
16. Cap screw (M8x35)
17. Brake shaft bellcrank
18. Brake pedal
19. Idler sheave
20. Flange nut (M6)
21. Cotter pin
22. Rolled pin (M4x20)
23. Safety wire
24. Washer (13/32x13/16x0.065 in.)
25. Lock nut (M8)
26. Cotter pin
27. Washer (13/32x13/16x0.065 in.)
28. Brake compression spring strap
29. Brake rod compression spring
30. Brake rod
31. Flange nuts (M8)
32. Adjustable idler sheave
33. Return-to-neutral strap
34. Brake rod return spring
35. Nut (3/8 in.)
36. Cotter pin
37. Washer (13/32x13/16x0.065 in.)
38. Brake lever mounting bracket
39. Brake lever
40. Adjustable coupler
41. Lock nut (13/32 in.)

SHIFT LINKAGE SYSTEM COMPONENT LOCATION



1. Cap screw (M6x20)
2. Shift arm
3. Lock nut (M6)
4. Lock nut (M10)
5. Flange nut (M8)
6. Neutral return strap
7. Shift knob
8. Neutral return bushing
9. Rolled pin (M4x20)
10. Shift lever
11. Shift lever neutral return spring
12. Spacer
13. Support strap
14. Shoulder bolt
15. Cap screw (M10x25)
16. Cap screw (M8x25)
17. Spacer
18. Flange nut (M8)
19. Lock nut (5/16-24 UNF 3B)
20. Shift link ball joint assembly (5/16-24 UNF)
21. Flange nut (M8)
22. Mounting stud (M10x76.5-Top/M8x40-Bottom)
23. Shift/return-to-neutral bracket
24. Flange nut (M8)
25. Lock nut (5/16-24 UNF 3B)
26. Woodruff Key (5/32x5/8 in.)
27. Anchored washer
28. Friction disc
29. Bellcrank
30. Friction disc
31. Anchored washer
32. Shift link
33. Tensioning spring
34. Snap ring

THEORY OF OPERATION

In this group the STX hydrostatic power train is separated into the following systems:

- Belt Traction Drive System
- Transaxle and Shift Linkage System
- Brake/Neutral Return System
- Transport (Free-Wheeling) System

BELT TRACTION DRIVE SYSTEM OPERATION

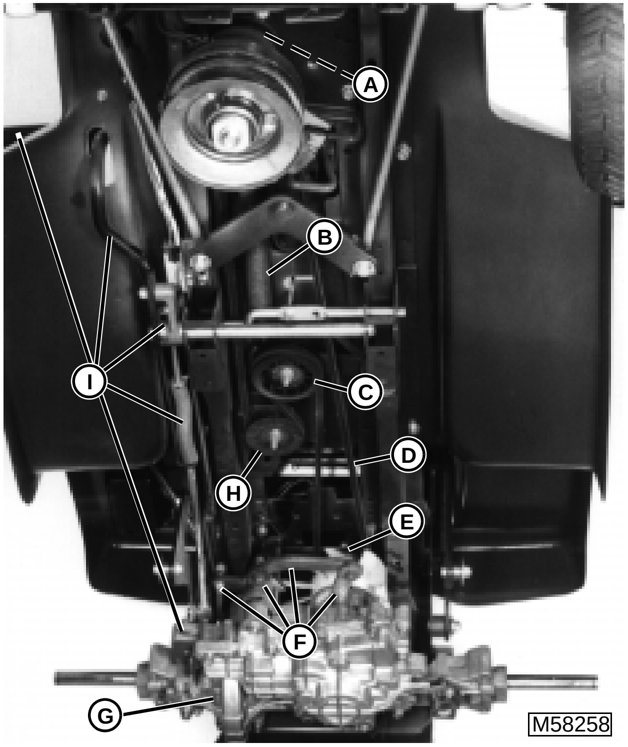
Function:

The function of this system is to transfer power from the engine to the hydrostatic transaxle.

Major Components:

- Foot pedal and brake linkage
- Engine drive sheave
- Traction drive belt
- Tensioning idler assembly
- Tensioning spring
- Adjusting idler assembly
- Transaxle drive sheave

Theory of Operation:



As soon as the engine is cranking, the engine drive sheave (A) pulls the drive belt (D). The drive belt, having been tensioned by the tension spring (B) and idlers (C and H), transmits power to the transaxle drive sheave (E). With the brake pedal linkage (I) released and hydro control linkage (F) engaged, the hydrostatic pump and differential matrix (G) drives the unit.

TRANSAXLE AND SHIFT LINKAGE SYSTEM OPERATION

Function:

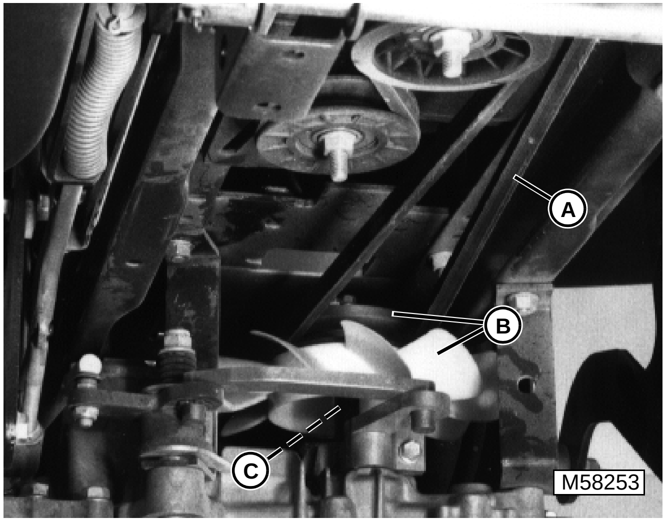
The transaxle transmits power from the engine, through the belt traction drive system, through the transaxle's hydraulic pump and motor center block matrix into the differential assembly and out the drive axles to the rear wheels. The transaxle provides infinite ground speed selections up to 5 mph in forward and up to 2.6 mph in reverse.

It also provides the means to interrupt the flow of power when shifted into neutral.

Major Components:

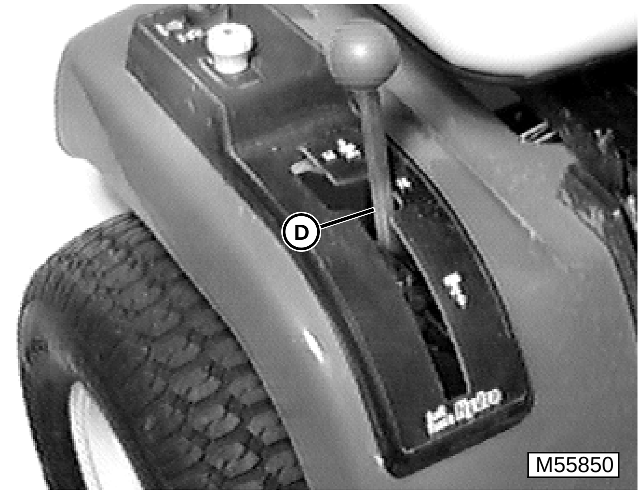
- Transaxle drive sheave and fan
- Pump (input) shaft and cylinder block assembly
- Shift linkage and pump swashplate assembly
- Center block assembly
- Motor cylinder block assembly and drive shaft
- Differential assembly and axle shafts
- Wheels and tires.

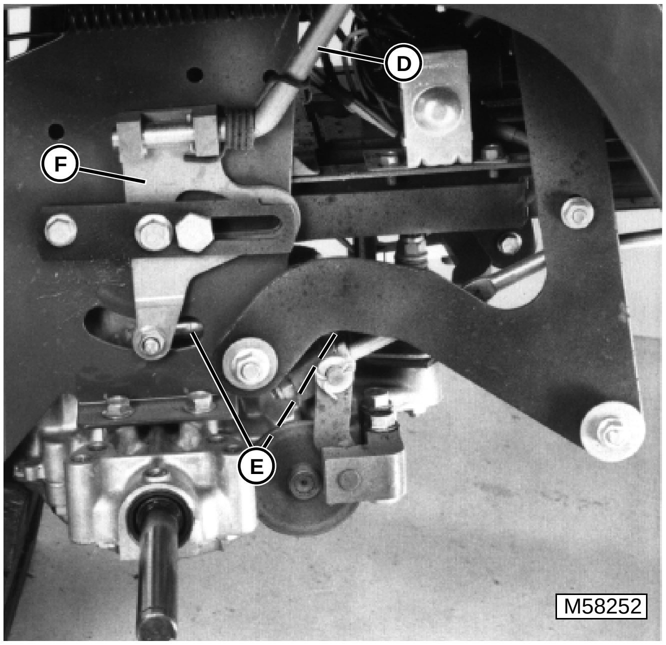
Theory of Operation:

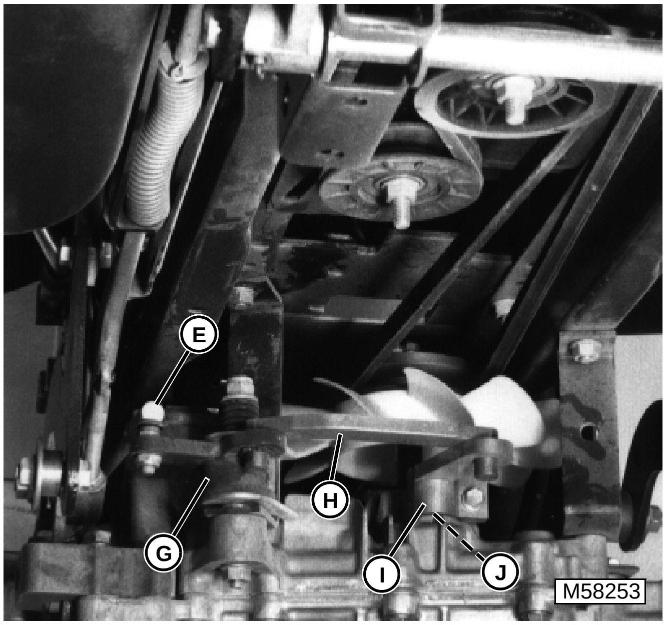


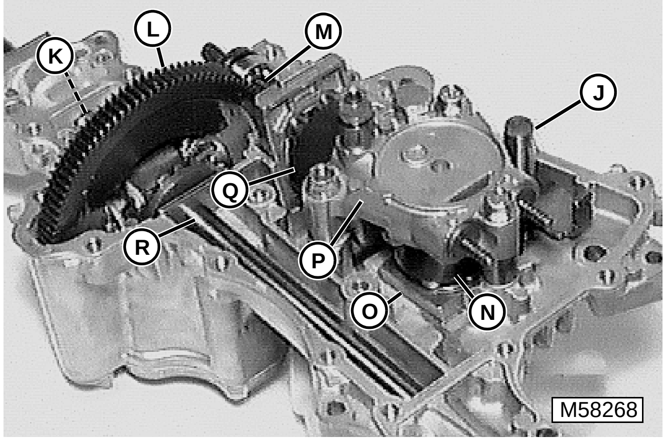
Neutral:

As soon as the engine is running, the traction drive belt (A) turns the transaxle input sheave and fan (B) rapidly in a clockwise direction. The sheave hub is splined and retained by a flat washer and flanged cap screw onto the splined pump (input) shaft (C).





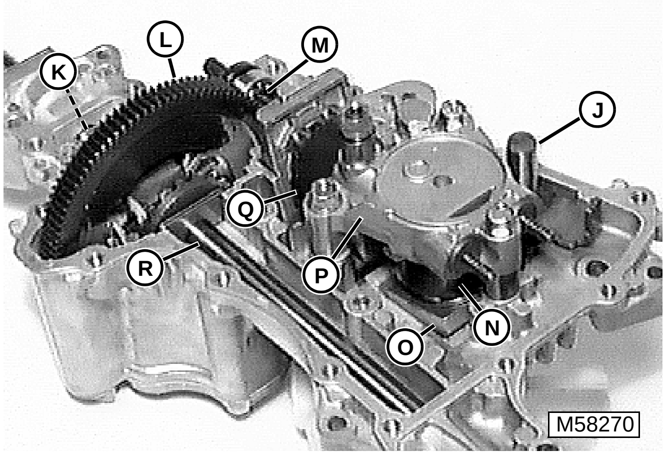




K50 Version Shown

When in neutral, the shift lever (D), shift bracket (F), turnbuckle link (E), bellcrank (G), link strap (H), and shifter shaft lever (I) hold the shifter shaft (J) and the variable-angle pump swashplate (O) in the neutral position. While in neutral (level) position, the pump cylinder block (N) rotates with the pump (input) shaft but does not pump any oil into the motor half of the center block (P) because the pump pistons are not moving up and down as they rotate. Therefore, the motor cylinder block (Q) does not turn nor do the motor (output) shaft (M), differential assembly (L), or drive axles (K and R).

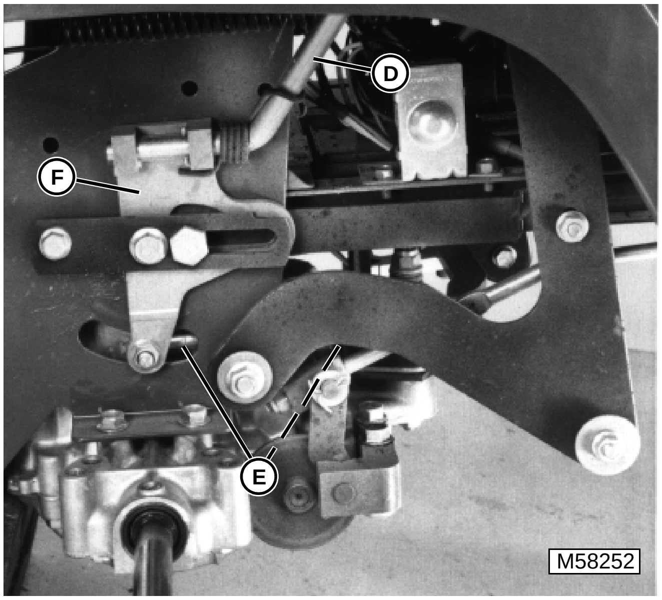
Forward:

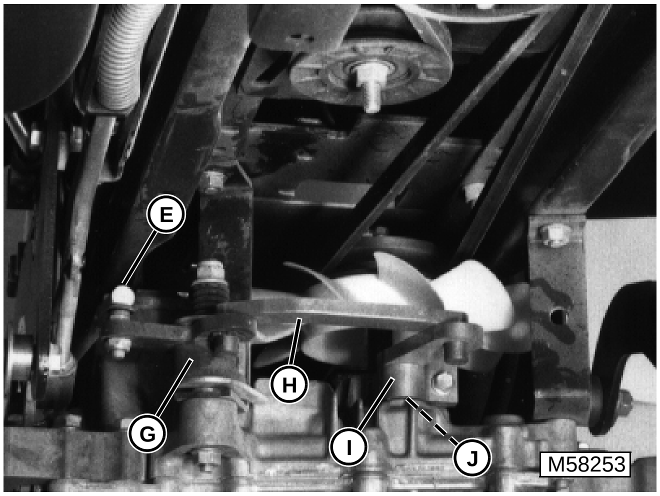


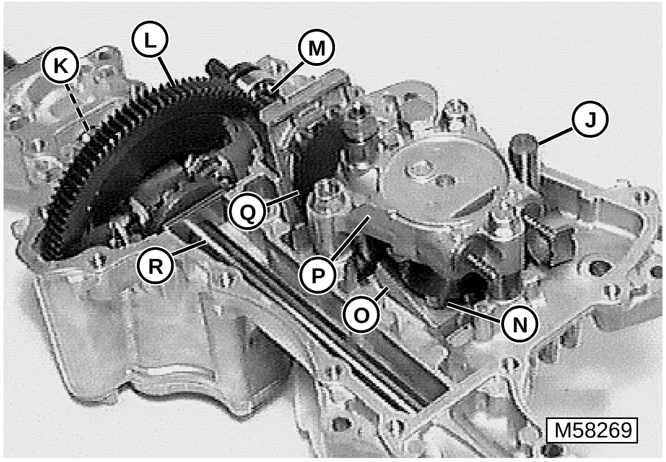
K50 Version Shown

When the shift lever (D) is moved into forward position, the shift bracket (F) pivots, pulling the turnbuckle link (E) rearward, pivoting the bellcrank (G), link strap (H), shifter lever (I), shifter shaft (J), and variable-angle pump swashplate (O) into forward position. With the pump swashplate angled in forward position, the pump cylinder block pistons (N) are pumping oil through one side of the center block (P) into the motor half of the center block, turning the motor cylinder block (Q) against it's fixed-angle swashplate and causing the motor (output) shaft (M), differential assembly (L), and drive axles (K and R) to turn in the forward direction.

Reverse:







K50 Version Shown

When the shift lever (D) is moved into reverse position, the shift bracket (F) pivots in the opposite direction, pushing the turnbuckle (E) forward, pivoting the bellcrank (G), link strap (H), shifter lever (I), shifter shaft (J), and variable-angle pump swashplate (O) into reverse position. With the pump swashplate angled in reverse position, the pump cylinder block pistons (N) are pumping oil through the other half of the center block (P) into the motor half of the center block causing the motor cylinder block (Q) to rotate against it's fixed-angle swashplate, turning the motor (output) shaft (M), differential assembly (L), and drive axles (K and R) in the reverse direction.

BRAKE/NEUTRAL RETURN SYSTEM COMPONENT LOCATION AND OPERATION

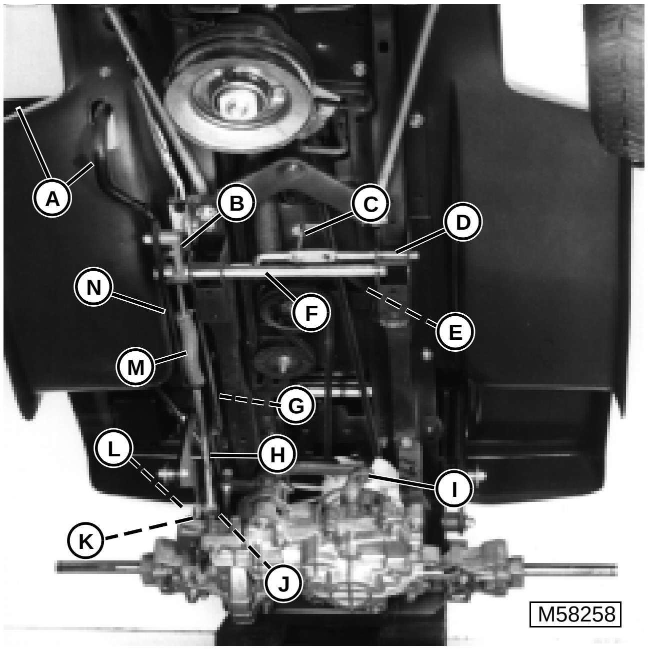
Function:

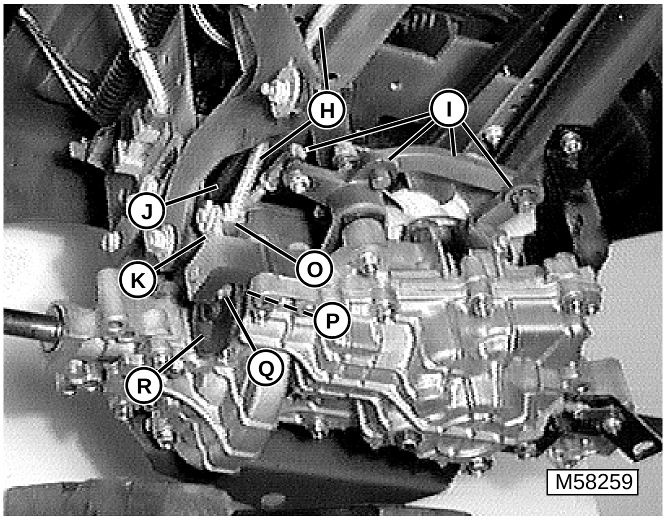
The brake system allows the operator to slow down or stop the tractor, return the shift linkage to neutral, and lock the brake into park.

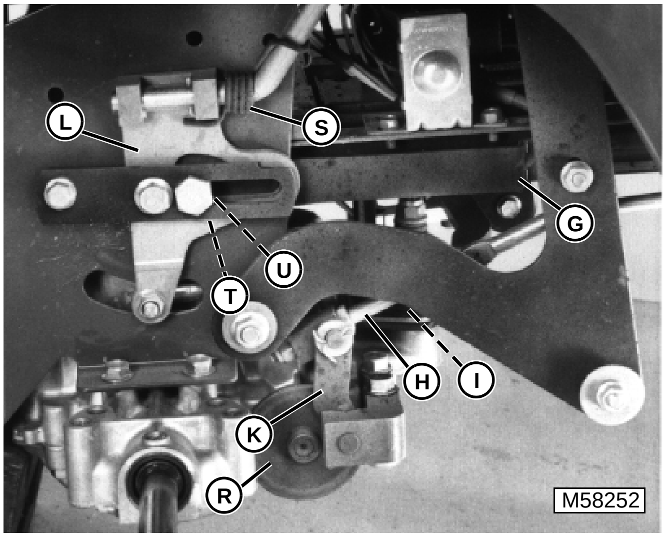
Major Components:

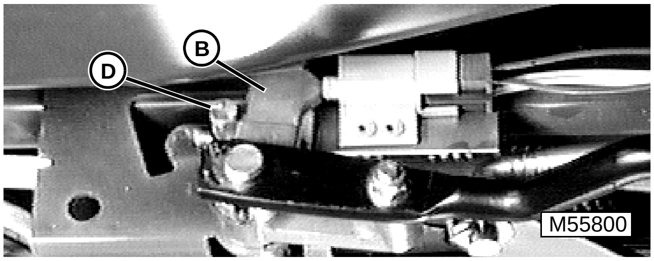
- Foot pedal
- Frame cross rod and bellcrank
- Brake rod, compress spring, and strap
- Brake rod return spring
- Brake rod adjustment coupler
- Transaxle brake assembly and return spring
- Shift linkage
- Shift/return-to-neutral bracket
- Shift bracket return-to-neutral strap and bushing
- Shift bracket support strap
- Park locking rod
- Park locking lever
- Park locking spring

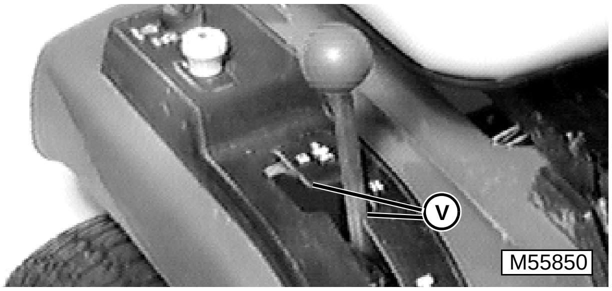
Theory of Operation:







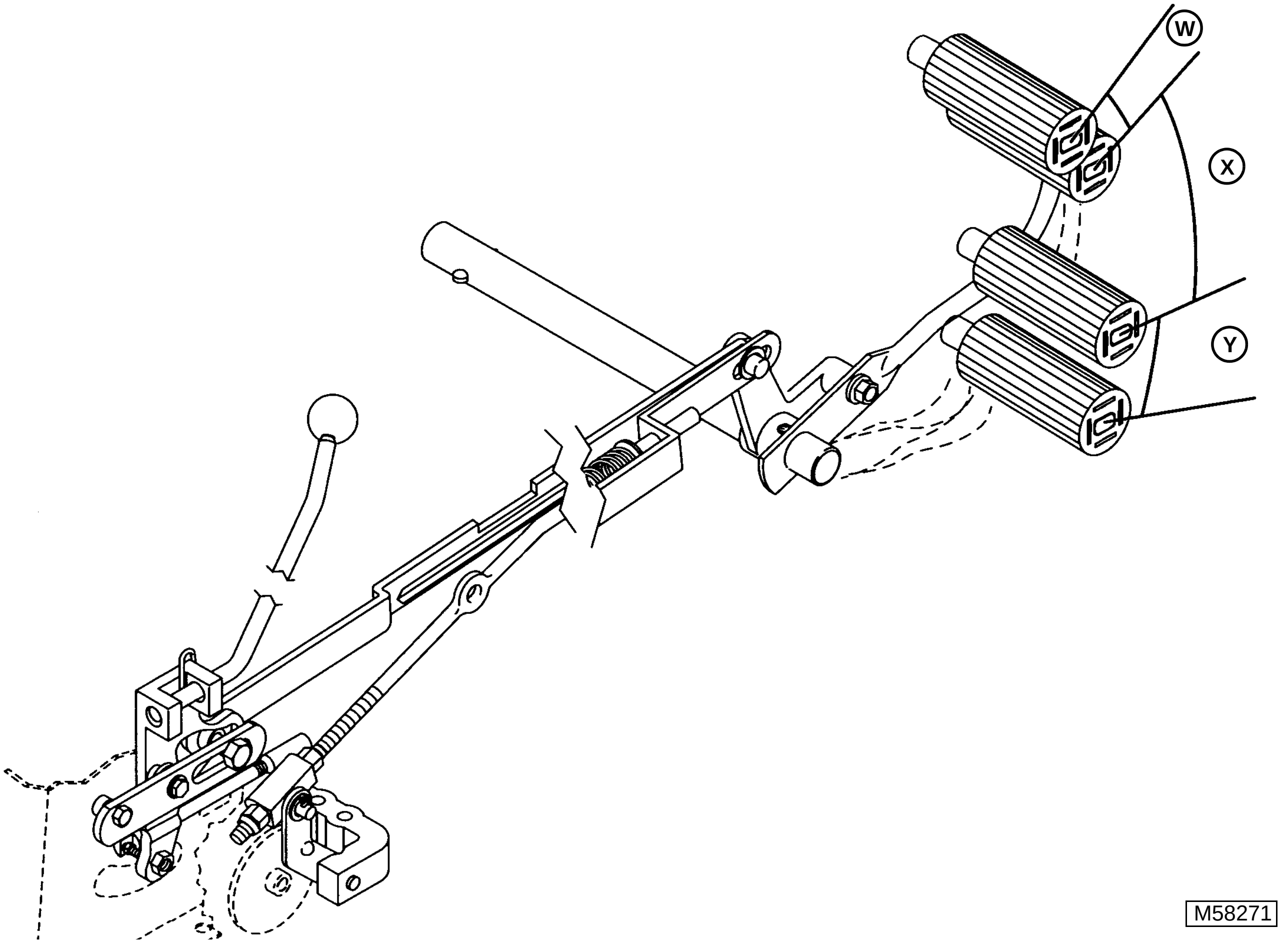




When the brake pedal (A) is depressed, the bellcrank (B) and frame rod (F) rotate forward. This motion causes the brake rod (H) and neutral return strap (G), connected at the same point on the bellcrank, to move forward at the same time. As the brake pedal is depressed further, spring strap (N) compresses the compression spring (M). As the spring is compressed, the brake lever (K) rotates forward forcing its friction surface (Q) against the brake disc (R). Continued force pushes the disc against the shimmed friction puck (P), captured in the housing. As the brake pedal is depressed further, more-and-more force is applied until the disc stops turning. This works in conjunction with the neutral return linkage, stopping the tractor.

As this is happening, the neutral return strap (G) is pulled forward, forcing the cam roller (U) to roll up one of the ramp contours of shifter bracket (L). This action moves the shifter bracket (L) and lever (D) back towards the neutral position. At the same time, this returns the shift linkage (I) into neutral position and the internal, variable pump swashplate into its level (non-pumping) position. This works in conjunction with the brake linkage, stopping the tractor. As-soon-as the shift lever reaches either of the radii of the neutral slot (V), the return spring (S) snaps the shift lever back into neutral position.

When the brake pedal is fully depressed, the brake can be locked into park position with the park lever (C) and locking rod (D). The locking spring (E) holds the locking rod in place until the operator eases up on the pedal and the force of compression spring (M) locks the bellcrank (B) against the locking rod (D). To release the park brake, the operator must again depress the brake pedal fully and pull the park lever (C) and locking rod (D) into the disengaged position. The brake rod neutral spring (J), maintains just enough air gap between the brake lever friction surface (Q), friction puck (P), and the brake disc (R) when the brake linkage is disengaged.



NOTE: Brake pedal has approximately 127 mm (5 in.) of travel.

1. The first segment of travel (W) is taking-up freeplay in the brake and return-to-neutral linkages.
2. The next segment of travel (X) is returning the shift linkage to neutral and engaging the brake.

IMPORTANT: Full brake engagement (drive wheels stop turning) must not occur until shift linkage has returned to neutral completely. If this is not the case, see Tests and Adjustments procedures later in this section.

3. The last segment of travel (Y) is locking and unlocking the brake linkage into park.

TRANSPORT (FREE-WHEEL) SYSTEM OPERATION

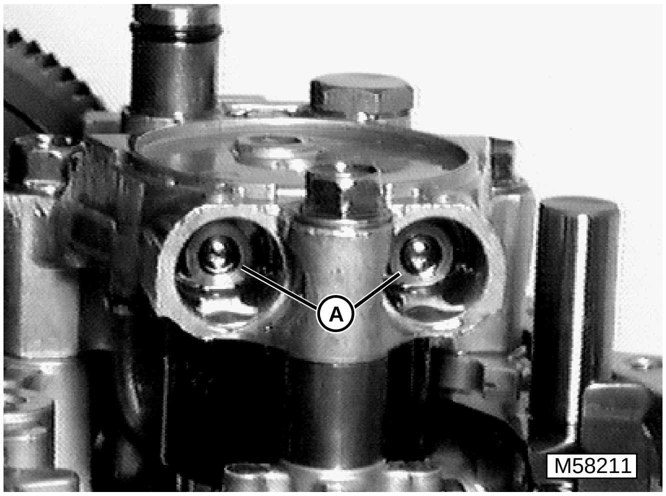
Function:

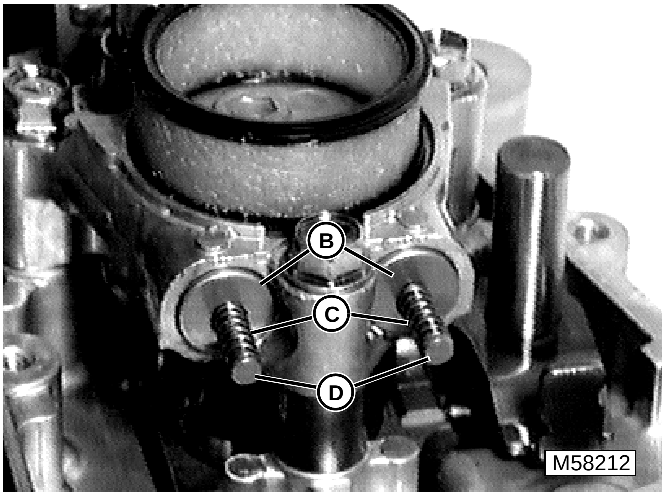
The transport (free-wheel) system allows the operator to push the tractor while the engine is off, transmission in or out of either forward or reverse, and the brake released.

Major Components:

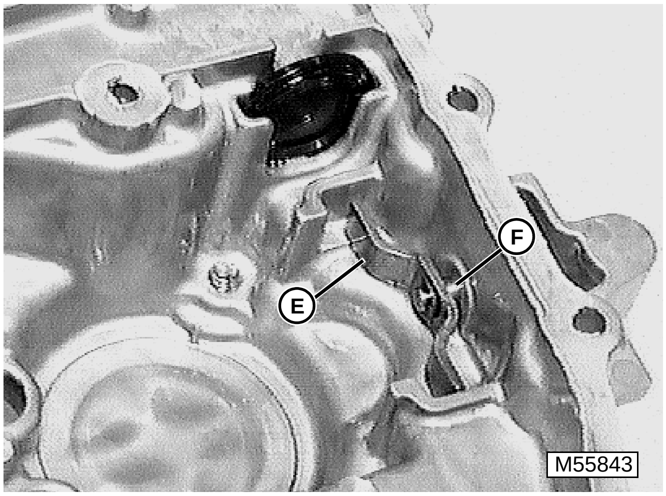
- Internal center block relief valve assembly
- Internal actuating assembly
- External over-center actuating lever assembly

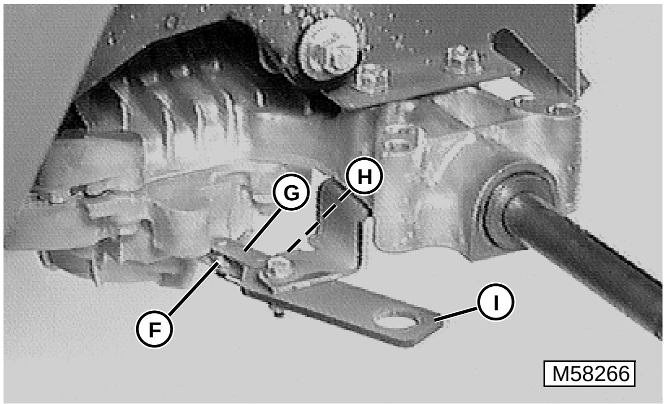
Theory of Operation:





K–50 Version Shown





A pair of bypass relief valves (A), located inside the center block of the transaxle, allow for oil to flow freely without the pump being turned by the engine and traction drive system.

When the actuating lever (I) is moved into its over-center locked position (H), the single chain link assembly (G) pushes the actuating pin (F) and bracket (E) against both valve pins (D). As the pins move inside their guides (B), the return springs (C) become compressed and the check balls of the relief valves (A) are unseated; allowing oil to flow freely. This allows the operator to push the tractor with the engine off and the brake released.

When the actuating lever (I) is returned to its disengaged position, the return springs (C) force the valve pins (D) out, allowing the check balls to seat in the relief valves (A), stopping oil free flow and the wheels from turning freely.

TROUBLESHOOTING

Problem or Symptom Check or Solution	Drive belt jumping off or	Lack of drive in one or both directions	Loses power under load, belt slips, or erratic drive	Jerky or aggressive engagement	Cannot get full forward speed	Cannot get full reverse speed	Returns to neutral during operation or under load	Shifts hard	Noisy operation	Leaking lubricant	Brakes will not stop tractor	Park brake will not hold	Transaxle overheats	Transport mode pushes hard	Loss of hydro drive or reduced power—Noisy
Drive belt sheaves and idlers loose, out of adjustment, worn, or damaged—tighten, replace, or adjust properly	●	●	●	●	●	●			●						●
Drive belt worn, frayed, glazed, or stretched—replace belt	●	●	●	●	●	●			●						●
Bellcrank tensioning spring weak or broken—replace as necessary	●	●	●		●	●			●						●
Brake pedal linkage out of adjustment—adjust properly		●	●	●	●	●	●	●	●		●	●		●	
Brake system components worn, bent, or broken—replace and adjust properly		●	●	●	●	●	●	●	●		●	●		●	
Shift lever linkage bent, worn, out of adjustment, or broken—replace or adjust properly		●	●	●	●	●	●	●	●		●				
Neutral return linkage worn, bent, or broken—replace as necessary		●	●		●	●	●	●	●		●	●			
Input sheave, input shaft, and axle keys or keyways loose, worn, or damaged—replace as necessary	●	●	●	●	●	●			●			●	●		●
Internal hydro transaxle components worn, stripped, or broken—replace as necessary		●	●	●	●	●	●	●	●		●		●	●	
Internal hydro pump and/or motor cylinder block and valve plate mating surfaces worn or scored—replace as necessary			●		●								●		●

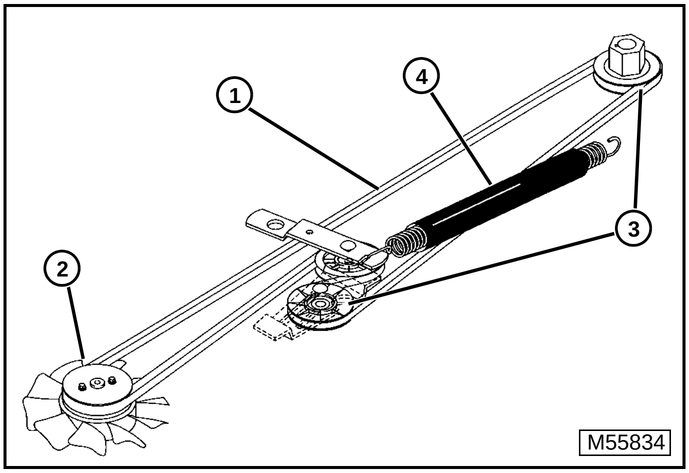
Problem or Symptom Check or Solution	Drive belt jumping off or	Lack of drive in one or both directions	Loses power under load, belt slips, or erratic drive	Jerky or aggressive engagement	Cannot get full forward speed	Cannot get full reverse speed	Returns to neutral during operation or under load	Shifts hard	Noisy operation	Leaking lubricant	Brakes will not stop tractor	Park brake will not hold	Transaxle overheats	Transport mode pushes hard
Transaxle case and mountings loose, worn, or broken—replace halves or mountings	●	●	●	●	●	●	●	●	●	●				
Fan loose or damaged—tighten or replace			●						●				●	
Incorrect type or volume of lubricant used—replace with correct type and volume		●	●	●	●	●		●	●	●			●	●
Bleed procedure overlooked or improperly done—repeat procedure correctly		●	●	●	●	●			●	●			●	●
Wheels and axle keys, key ways, or snap rings worn—replace as necessary	●	●	●	●	●	●			●			●		
Motor drive shaft or axle seals worn or damaged—replace seals		●	●		●	●	●	●	●	●			●	
Transaxle case halves cap screws loose or stripped—tighten or replace screws		●	●	●	●	●	●	●	●	●			●	
Poor application of transaxle case halves sealant—replace sealant properly		●	●		●	●		●	●	●			●	
Incorrect type sealant—replace with proper sealant		●	●		●	●		●	●	●			●	
Transport (free-wheeling) valves and linkage out of adjustment or damaged—readjust or replace as necessary		●	●	●	●	●	●						●	●
Engine performance problems—see Engine Section		●	●	●	●	●								

DIAGNOSIS

Test Conditions:

- Tractor on level surface.
- Engine OFF.
- Front wheels blocked.
- Rear wheels raised off surface with axle housings on jack stands.

Test/Check Point	Normal	If Not Normal
1. Drive belt	Belt in good condition, not glazed, split, unraveled, or stretched.	Replace drive belt as needed.
2. Fan	Fan in good condition and tight.	Tighten fan. Repair or replace as needed.
3. Sheaves and idlers	Drive sheaves and idlers in good condition and adjusted properly.	Adjust idler assembly. Repair or replace as needed.
4. Tensioning spring	Tensioning spring and anti-vibration hose (early models only) installed and not damaged.	Install spring and hose (if equipped). Repair or replace as needed.
5. Shift linkage	Shift linkage adjusted properly and working smoothly.	Adjust as needed. Repair or replace as needed.
6. Brake linkage and assembly.	Brake and brake linkage adjusted properly and working smoothly. Brake components not worn or damaged.	Adjust as needed. Repair or replace as needed. Repair or replace as needed.
7. Neutral return linkage.	Neutral return linkage adjusted properly and working smoothly.	Adjust as needed. Repair or replace as needed.
8. Hydro housing exterior.	No cracks, leaks, or loose hardware.	Tighten hardware. Repair or replace transaxle housing. Replace any damaged components.
9. Axles	Axles straight. Keys and keyways all in good shape.	Repair or replace as needed. Repair or replace as needed.
10. Internal hydro components.	No worn, scored or scratched components. Correct type and quantity of oil. Oil not dirty or burnt. Retaining snap rings in good shape and seated correctly.	Repair or replace as needed. Fill to proper level. Replace with correct or unburned oil. Repair or replace as needed.
11. Transport (free wheeling) valve and linkage.	Transport linkage engaging and disengaging properly.	Adjust. Repair or replace as needed.
12. Wheels and tires.	Air pressure equal in driving tires. Driving tires have same radii. Wheels not bent or out of round.	Adjust air pressure. Match tires for same radii. Repair or replace wheels as necessary.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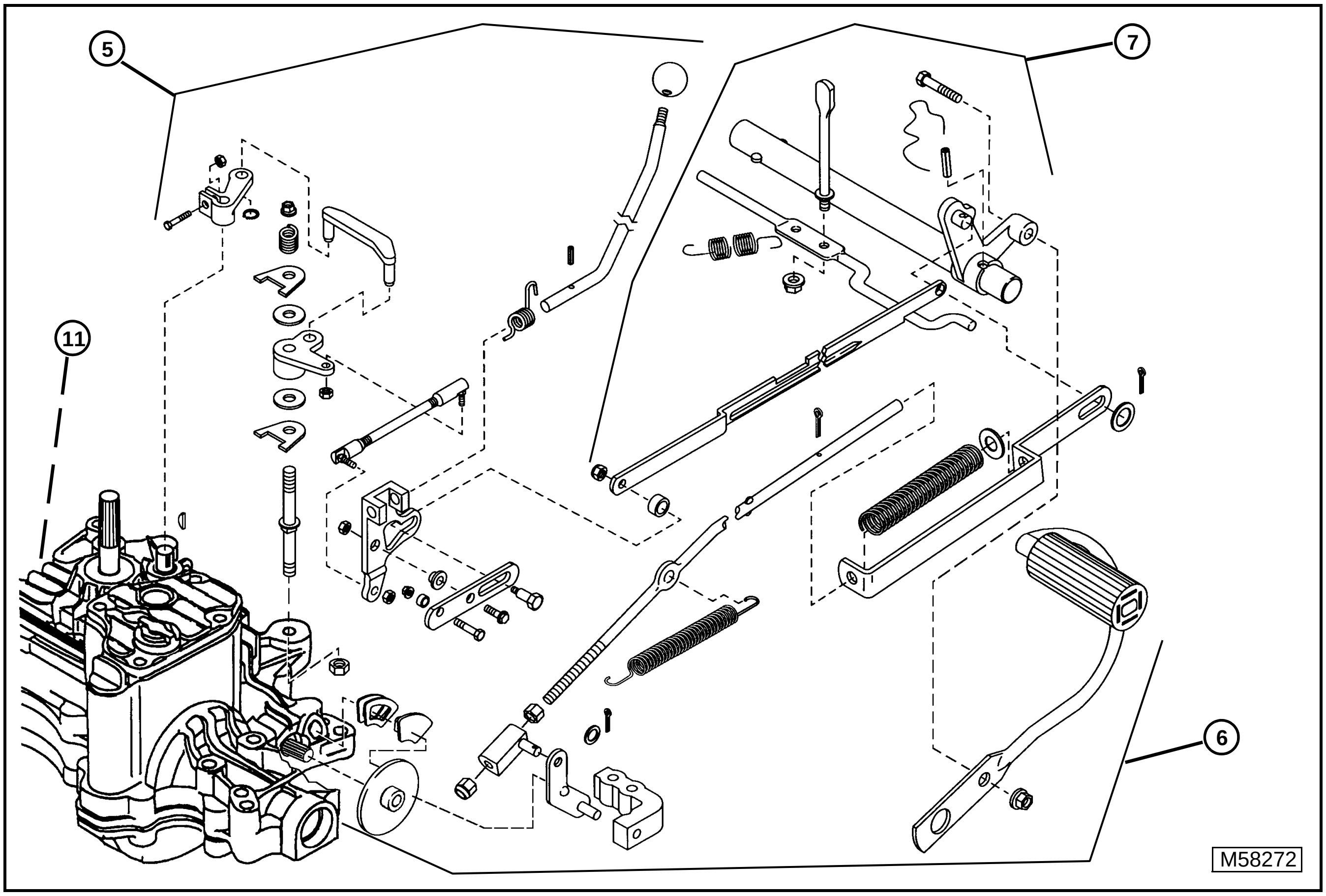
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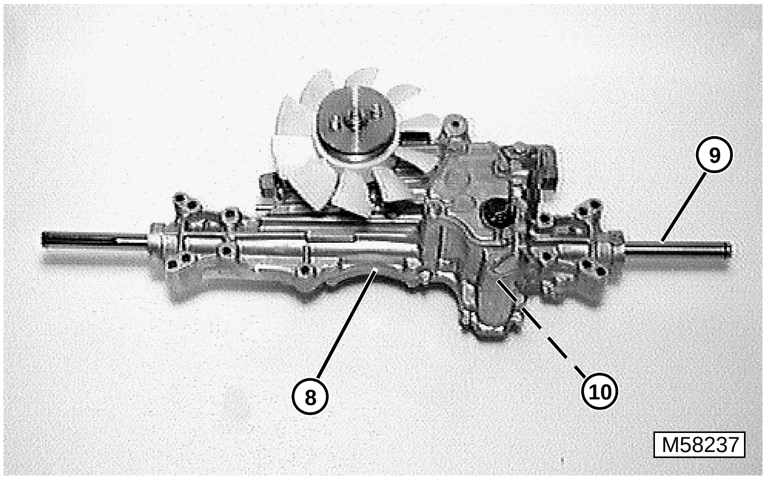
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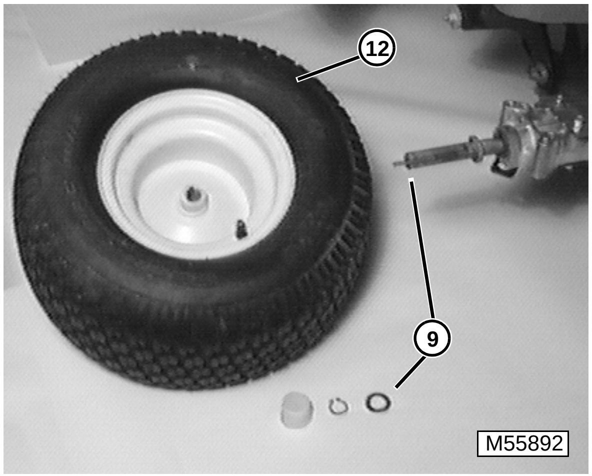
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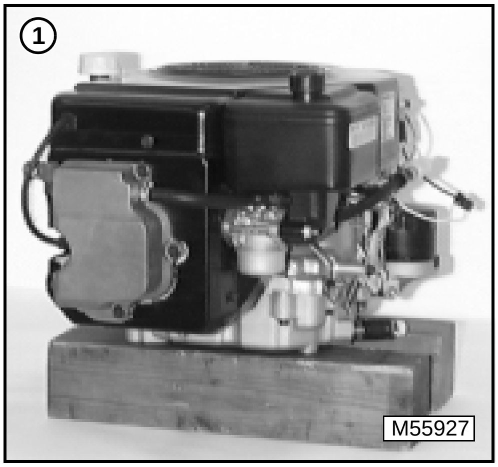
DIAGNOSIS CONTINUED

Test Conditions:

- Tractor operating in test area.
- Engine at operating temperature.
- Tests run at engine slow idle and fast idle.
- Hydro run through full range of speeds in both directions.

Test/Check Point	Normal	If Not Normal
1. Engine performance.	Engine running smoothly throughout throttle range.	Adjust, tune, or repair engine.
2. Belt traction drive system.	Belt not slipping, squealing, or vibrating excessively.	Check belt condition, check adjustment and condition of idlers and guides. Adjust, repair or replace components as needed.
3. Shift linkage operation.	Shifting is smooth, full speed obtained, and constant speed is maintained (little or no movement in linkage when shift lever is released).	Check shift linkage condition. Check bellcrank friction discs and tensioning spring adjustment. Adjust, repair or replace components as needed.
4. Return-to-neutral/brake and park brake linkage operation.	Brakes stop tractor and park brake holds tractor stationary on 17° slope. Return-to-neutral/brake linkage engages brake and returns shift lever linkage back into neutral.	Check brake pedal, return-to-neutral, and park brake linkages. Check brake disc and friction pucks for wear. Adjust, repair or replace components as needed.
5. Transaxle performance.	Transport (free-wheel) valve when engaged allows operator to push tractor with little effort. When disengaged, tractor moves only by starting engine and engaging transaxle. Transaxle operates smoothly throughout forward and reverse ranges. STX38 (M00STXC210001—270000) (M00STXJ270001—290000) STX46 (M00STXG240001—270000) (M00STXL270001—290000) One or more piston springs may be missing in the pump or motor cylinder block. With the spring missing, piston washer may slip out of piston and damage surfaces of the cylinder blocks, plates, and center block.	Check transport (free-wheel) valve and linkage adjustment and condition. Check hydro internal components and fluid level. See drive belt adjustment and bellcrank spring tension adjustment. Adjust, repair or replace components as needed.
6. Axles, wheels, and tires.	Axles, wheels, and tires in good shape and functioning properly.	Check axles and wheel for straitness, check condition of keys and keyways, washers, and snap rings. Check tires for tread wear and proper inflation. Repair or replace components as needed.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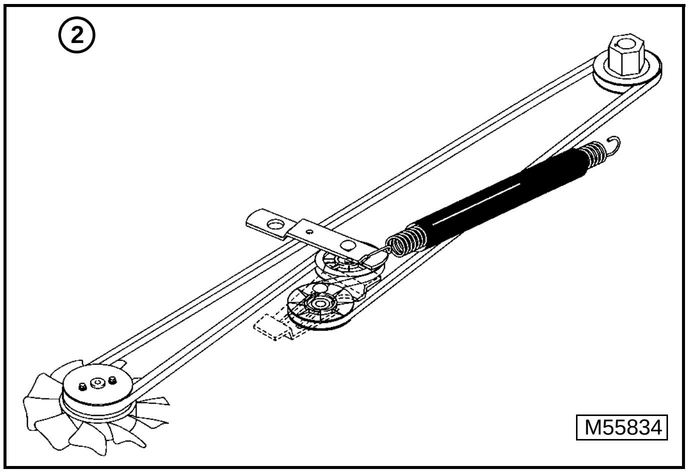
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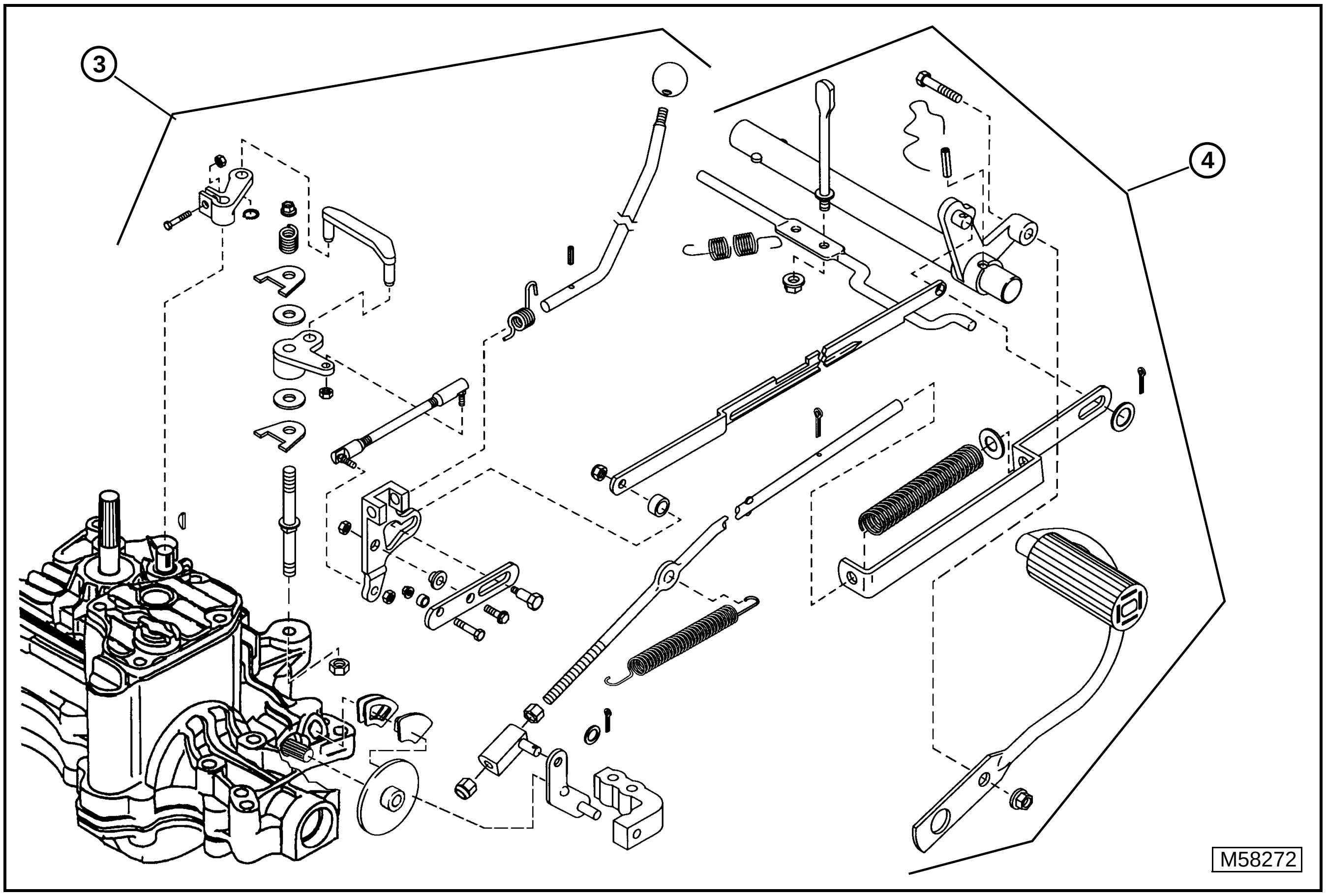
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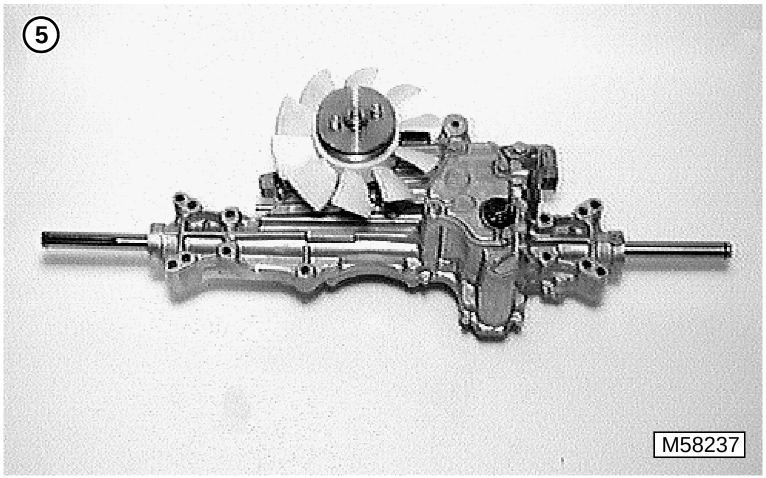
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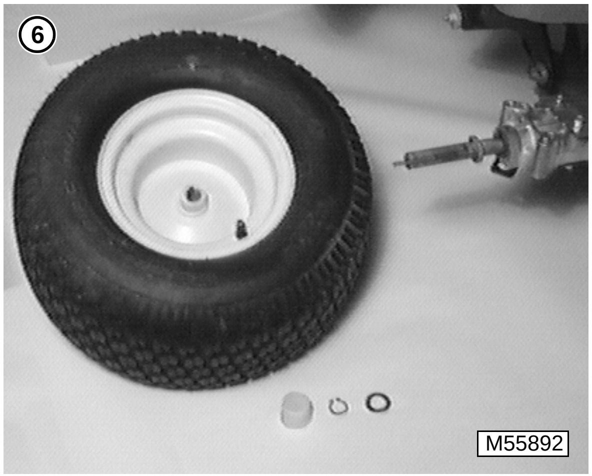
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TESTS AND ADJUSTMENTS

TRACTION DRIVE SYSTEM

Reason:

To ensure shift, neutral return, and brake linkages and belt drive system maintain traction in lower 1/3 of forward speed range up a 17° slope. To ensure that transport (free-wheeling) valve assembly and linkage allow tractor to be pushed when engaged and to drive tractor when disengaged. Also, to ensure tractor returns to neutral, engages the brake, stops tractor within specification, and holds tractor stationary in PARK position on a 17° slope or less.

Procedure:

NOTE: This is a six part test and adjustment procedure:

- Test drive on 17° slope,
- Drive belt adjustment,
- Transport valve linkage adjustment
- Shift linkage adjustments,
- Brake rod adjustment,
- Repeat test drive on 17° slope.

Test Drive—

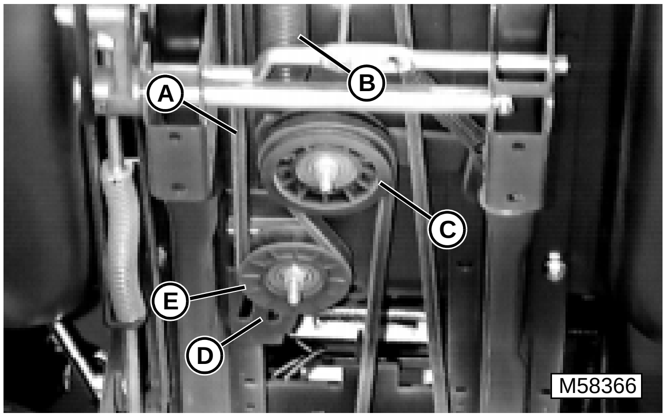
CAUTION

DO NOT engage shift lever too aggressively or tractor may tip over backwards. while performing the test drive on a 17° slope.

1. Test drive tractor to see if traction drive system pulls tractor up a 17° slope in lower 1/3 of forward range.
2. Look for a steady pull up the slope.
3. If test fails in any of the lower 1/3 range, the belt tension must be adjusted.

4. Drive or push tractor onto a 17° slope, depress the brake pedal and lock it in PARK position.
5. **Shift lever and linkage must return-to-neutral, park brake must hold tractor stationary on slope, and tractor must not creep downward once park brake is locked into position.**
6. Drive tractor on dry pavement in a safe, open, and level area at fast idle in full forward position. Apply a "panic stop" force (no more than 50 pounds of force)—**tractor must stop within 0.9—1.5 M (3—5 ft) and both wheels should "lock-up", leaving skid marks on pavement.**
7. Repeat Steps 4—6 for reverse.
8. If any test fails, the brake linkage and return-to-neutral linkage must be adjusted or components replaced.

DRIVE BELT ADJUSTMENT



1. Lock park brake.

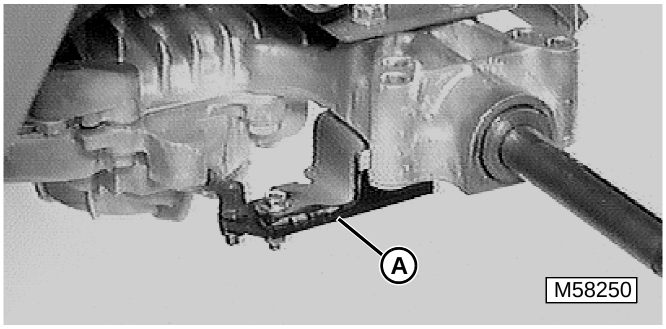
CAUTION

Tensioning spring (B) is under high tension. Wear gloves and use a firm grip when stretching spring.

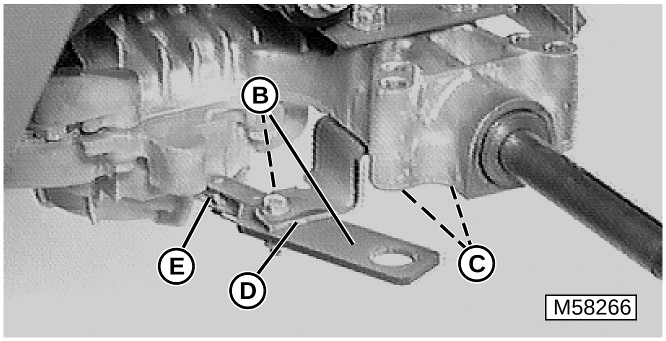
2. Carefully pull larger tensioning idler (C) rearward until belt (A) can be removed from adjustable idler (E), then slowly release tensioning idler.
3. Loosen and move adjustable idler (E) rearward in slot (D) in increments of **10 mm (0.39 in.)**.
4. Tighten adjustable idler (E) and carefully install belt in larger tensioning idler (C).
5. Repeat procedure until belt tension is sufficient to overcome any slippage.
6. If adjustable idler is adjusted to rear end of slot (D) and belt tension is not sufficient to overcome any slippage, replace belt.

NOTE: If a new belt is required, adjustable idler (E) should be reset at front end of slot (D).

TRANSPORT (FREE-WHEEL) VALVE ADJUSTMENT



1. Replace lever assembly (A) components as needed.



2. Slowly engage lever (A) into over-center position (B).
3. Watch closely that actuating pin (E) moves inward all-the-way and, as lever snaps into over-center position, does not move outward at all.
4. If actuating pin (E) does move outward, loosen mounting nuts (C).
5. Push and hold edge of mounting bracket (D) inward until actuating pin (E) bottoms out (internally). Hold edge of bracket (D) stationary while axle mounting nuts (C) are tightened to specification.

Specification:

Transaxle mounting nuts

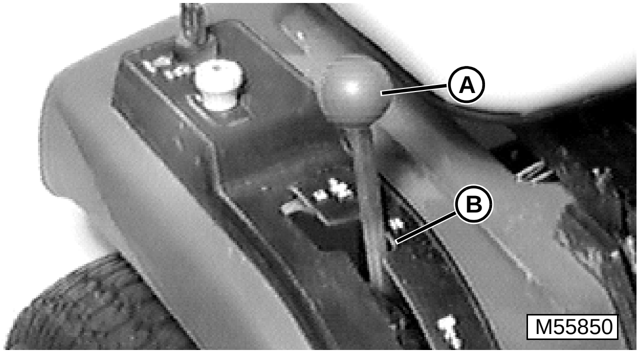
. . . . 20.3—47.4 N•m (180—420 lb-in.)

Test Transport Valve Operation:

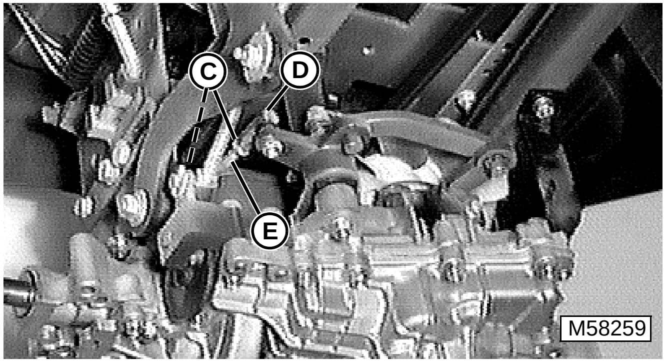
1. With engine off and shift lever in any position, put transport valve lever (A) in over-center position (B) and push tractor forward at least 3.05 M (10 ft)—tractor should push easily the entire distance.
2. Push tractor backward the same distance—tractor should push easily the entire distance.
3. If tractor pushes hard, repeat adjustment procedure above—be sure actuating pin (E) does not move outward once over-center position (B) is achieved and mounting nuts (C) are tightened.
4. Repeat test Steps 1 and 2.
5. If tractor still pushes hard, internal component are not assembled properly or are damaged. Remove transaxle and make necessary inspection and repairs (see Repair Group later in this section).

SHIFT LINKAGE ADJUSTMENT

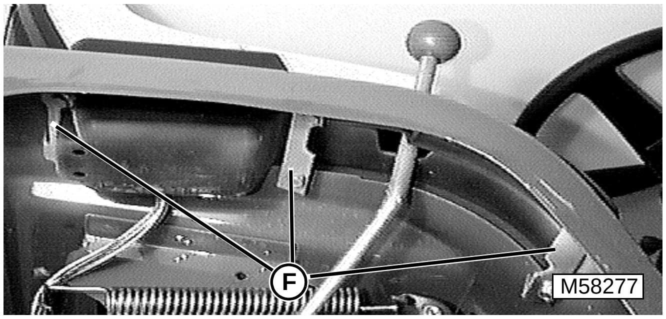
1. Safely raise rear of tractor off the surface and block the front wheels. Remove rear wheels to gain access to transaxle shift linkage and to safely check for creep in transaxle (axles turning while shift linkage is in neutral position without brake engaged).
2. Check that all shift linkage hardware is in good condition and tight. Replace components as necessary.



3. With park brake unlocked, cycle shift lever (A) into full forward and step on brake pedal to return shift lever into neutral position (B). DO NOT move shift lever by hand.
4. Run engine at fast idle and check that transaxle does not creep while shift lever is in this position.

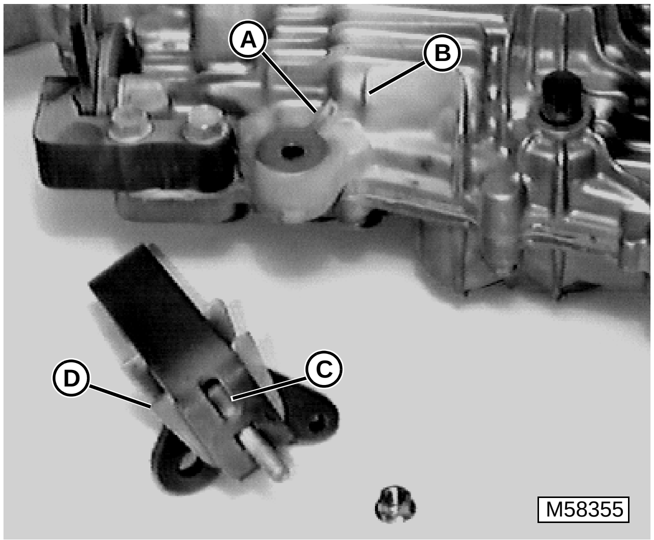


5. If transaxle creeps, loosen front and rear jam nuts (C) of turnbuckle assembly (D).
6. Use flats (E) to turn threaded link (use 1/4 turn increments) clockwise to shorten turnbuckle length or counterclockwise to extend turnbuckle length.
7. Adjust turnbuckle length until creep stops. Hold flats (E) stationary and tighten jam nuts (C).
8. Only as a last resort, if prior adjustment fails to stop creep motion with few threads of link left, would you adjust shift quadrant forward or rearward.

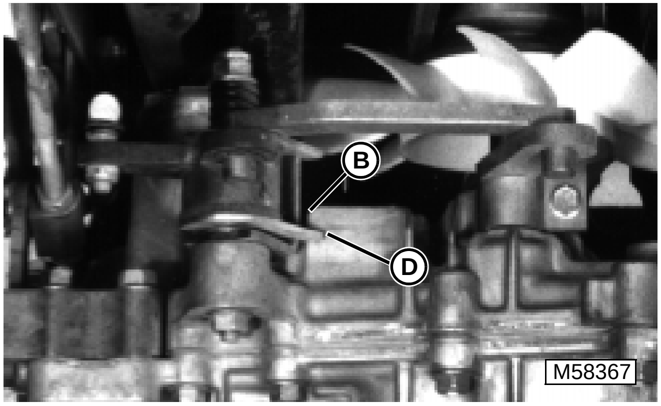


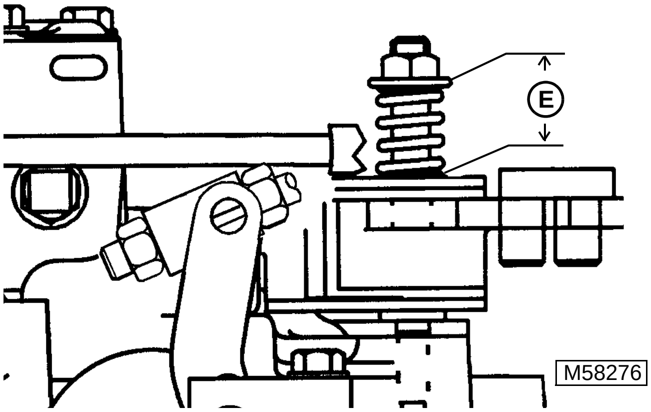
9. Loosen shift quadrant three mounting brackets (F).
10. With engine at fast idle, move quadrant forward or rearward until creep motion stops with shift lever in return-to-neutral position (via brake pedal).
11. Holding quadrant in place, turn engine off and tighten three mounting brackets (F).
12. With engine running at fast idle, re-cycle shift lever and return-to-neutral linkage several times to ensure adjustment eliminates creep.

BELLCRANK SPRING TENSION ADJUSTMENT



1. Make sure bellcrank assembly and transaxle right, front mounting bracket are oriented properly. Slot (C) should be aligned with transaxle housing rib (A) so that ear (D) of lower anchor washer **is not** wedged behind housing vertical rib (B).





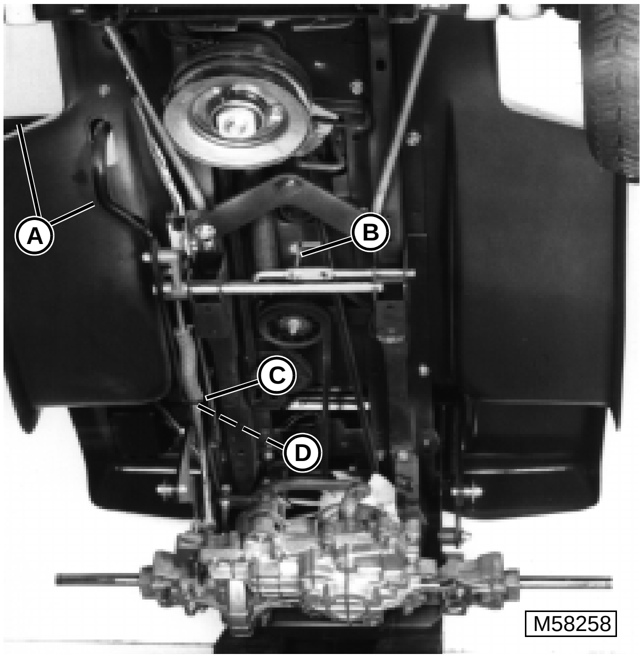
2. Check shift linkage bellcrank spring tension by measuring spring length distance (E) between flanged nut and top anchor washer and adjust to specification. This will ensure shift lever will remain stationary wherever operator lets go of lever anywhere in shift quadrant. This adjustment may vary from one operator's preference to the next.

Specification:

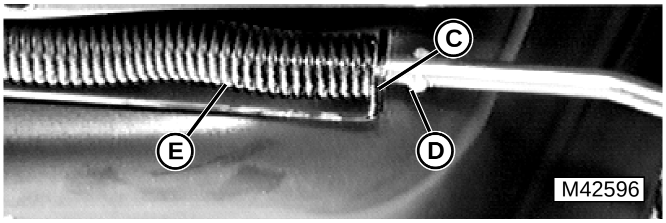
Bellcrank spring length (maximum)

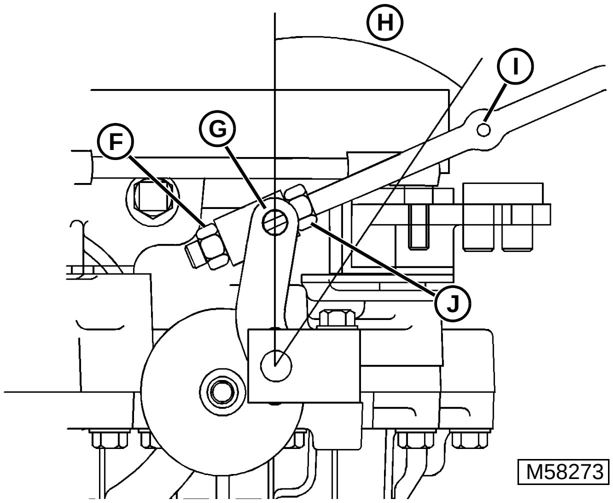
Production spring	**15±1 mm (0.59±0.04 in.)**
Service spring	**21±1 mm (0.83±0.04 in.)**

BRAKE SPRING ADJUSTMENT



1. Unlock park brake lever (B) and release brake pedal (A).

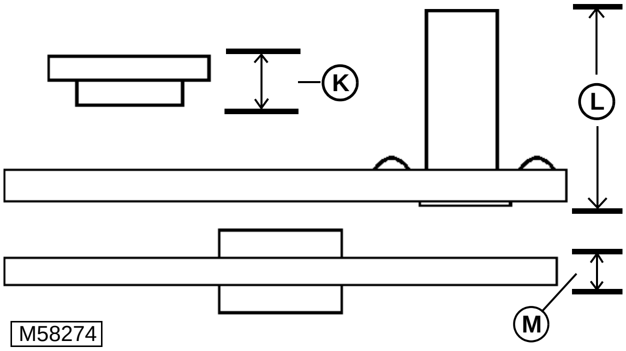




2. Measure distance between centers of brake lever hole (G) and brake rod hole (I), distance should be **85 mm (3.35 in.)**.
3. If not, gradually adjust jam nuts (F and J) until specified measurement is obtained.
4. Depress pedal (A) and lock park brake (B).
5. Measure distance between end of compression spring bracket (C) and front edge of brake rod stop tabs (D), gap should have a **minimum distance of 2 mm (0.08 in.).**
6. Check brake rod compression spring (E), it should **not be** completely compressed, as shown, when park brake is locked. A slight air gap should be visible between the coils when proper adjustment is reached.
7. Recycle park brake a few times and remeasure distances each time until specified measurements are obtained.
8. Brake lever travel (H) should **not exceed 30°**, if it does measure brake components individually.

Specifications:

Brake lever hole-to-brake rod hole	**85 mm (3.35 in.)**
Spring bracket-to-stop tabs (minimum)	**2 mm (0.08 in.)**
Brake lever travel (maximum)	**30°**



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Specifications:

Brake Components Wear Tolerances—
(K) brake puck (minimum) . . . . 8 mm (0.3 in.)
(L) brake lever (minimum) . . . . 25 mm (1.0 in.)
(M) brake disc (minimum) . . . . . 2.5 mm (.098 in.)

IMPORTANT: See page 6-46 Brake Pad Adjustment to insure brake gap is set properly.

9. Replace components as necessary.
10. Install rear wheels, and lower tractor to surface.

REPEAT TEST DRIVE

⚠ CAUTION

DO NOT engage clutch/brake pedal too aggressively or tractor may tip over backwards. It is recommended that you hang the mower deck from the tractor before performing the test drive on a 17° slope.

1. Attach mower deck to tractor—this will help stabilize the tractor.

M42597

2. Carefully test drive tractor to see if traction drive system pulls tractor steadily up a 17° slope in lower 1/3 of forward range.
3. Look for a steady pull in all three lower gears up the slope. If tractor fails traction test, inspect traction drive belt:

- if belt is excessively worn, stretched, glazed, or unraveling—replace it (see Inspect, Remove, and Install Traction Drive Belt in the Repair Section),
- if belt is not excessively worn, make finite adjustments above or below specification to gain proper response in traction drive system. Remember: to lengthen clutch spring causes increased traction and aggressiveness; to shorten clutch spring causes decreased traction and aggressiveness.

M42598

4. Drive tractor onto a 17° slope and lock clutch/brake pedal in park position. Check that park brake holds tractor stationary on slope and that tractor does not creep downward once park brake is set.
5. If tractor fails park brake test, inspect brake assembly components and replace as necessary.
6. Return to work area and finish installing mower.

Results:

- Test drive tractor to ensure full forward and reverse speeds are obtained and that transaxle does not creep in neutral position.
- If adjustments are not satisfactory, repeat procedure until proper results are obtained.
- If adjustments are still not satisfactory, internal transaxle repair is needed.

REPAIR

TRACTION DRIVE BELT REMOVAL/ INSPECTION/INSTALLATION

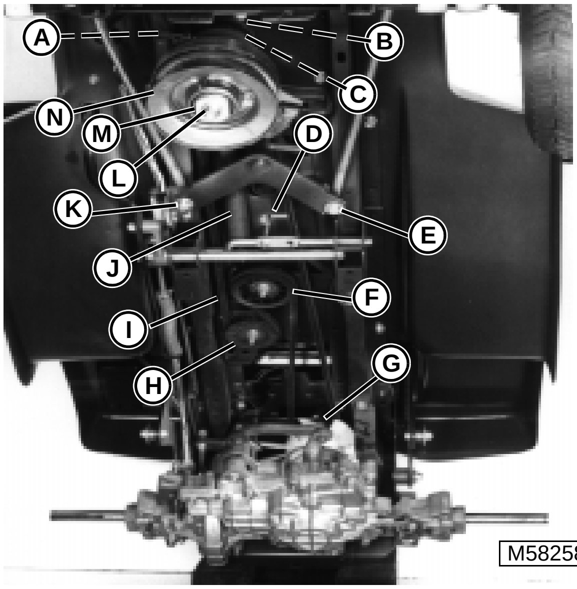
NOTE: If drive belt is in good condition, it doesn't have to be completely removed to take out the transaxle. Follow Removal Steps 1—4 below, then remove belt from transaxle drive sheave.

Removal—

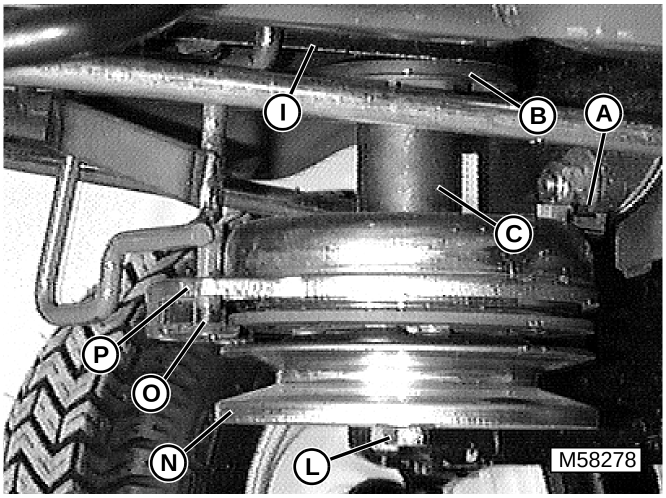
1. Park tractor on level surface and remove battery.
2. Remove mower deck.
3. Safely raise and block tractor to gain easy access to underside of frame.

⚠ CAUTION

Tensioning spring (J) is under high tension. Wear gloves and use a firm grip when stretching spring.



4. Pull larger tensioning idler (F) rearward until belt (I) can be removed from adjustable idler (H), larger tensioning idler (F), and transaxle drive sheave (G).
5. Remove park brake lever (D) from locking rod.
6. Disconnect both steering rods (E and K) from steering yoke and swing them out-of-the-way.
7. Disconnect PTO clutch wiring harness connector (A).
8. Hold PTO clutch mounting washer (M) stationary with a large open-end wrench while you remove mounting cap screw (L).



9. Remove PTO clutch assembly (N) and engine crankshaft coupler (C).
10. Remove belt (I) from engine drive sheave (B) and remove sheave from crankshaft.
11. Remove belt from tractor.

Inspection—

1. Inspect drive belt.

Effective Length—	
New	**2485 ±8 mm (97.8 ± 0.3 in.)**
Minimum	**477 mm (97.5 in.)**
Maximum	**2530 mm (99.6 in.)**
Top Width—	
New	**13.11 mm (0.52 in.)**
Minimum	**10 mm (0.39 in.)**
Bottom Width—	
New	**7.93 mm (0.31 in.)**
Minimum	**6 mm (0.24 in.)**
Depth—	
New	**9.46 mm (0.37 in.)**
Minimum	**7 mm (0.28 in.)**

2. Replace belt as necessary.

Installation—

1. Install drive belt in reverse order of removal.
2. Coat mating surfaces of engine crankshaft OD, ID of traction drive sheave (B), ID of PTO clutch coupler (C), and ID of PTO clutch (N) with John Deere Never-Seez® before installation. (Hint: hold sheave in place by seating drive belt in sheave groove.)
3. BE SURE to align anchor slot (P) of PTO clutch assembly with vertical rod (O) of frame weldment belt guide.
4. Tighten PTO clutch cap screw (L) to specification. Use flats of washer (M) to hold crankshaft still.

Specification:

PTO clutch cap screw	**75 N•m (55 lb-ft)**

TRACTION DRIVE BELT TENSIONING SYSTEM REMOVAL/ INSPECTION/INSTALLATION

1. Remove mower deck.
2. Use this drawing for complete repair of system.

⚠ CAUTION

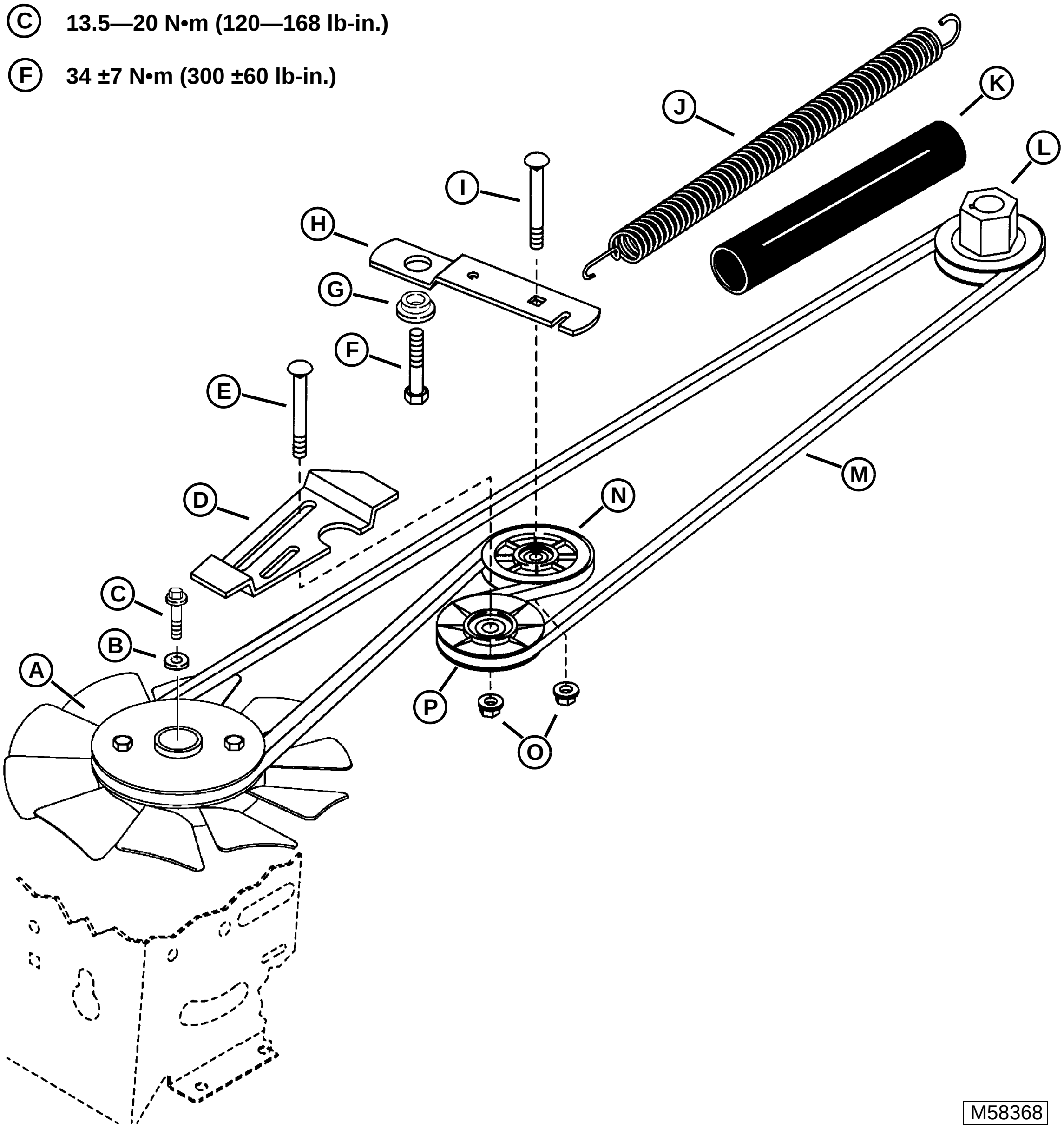
Bellcrank tensioning spring (J) is under high tension. Use locking pliers or spring puller tool. Wear safety glasses and gloves when removing or installing bellcrank tensioning spring.

3. Install mower deck.

A. Transaxle drive sheave
B. Washer
C. Cap screw (M6x25)
D. Adjustable idler weldment bracket
E. Carriage bolt (M8x35)
F. Cap screw (M8x20)
G. Bushing
H. Bellcrank
I. Carriage bolt (M8x45)
J. Tensioning spring
K. Anti-vibration hose (early models only)
L. Crankshaft drive sheave
M. Drive belt
N. Bellcrank idler
O. Flange nuts (M8)
P. Adjustable idler

Ⓒ **13.5—20 N•m (120—168 lb-in.)**

Ⓕ **34 ±7 N•m (300 ±60 lb-in.)**



POWER TRAIN LINKAGE SYSTEM REMOVAL/INSPECTION/ INSTALLATION

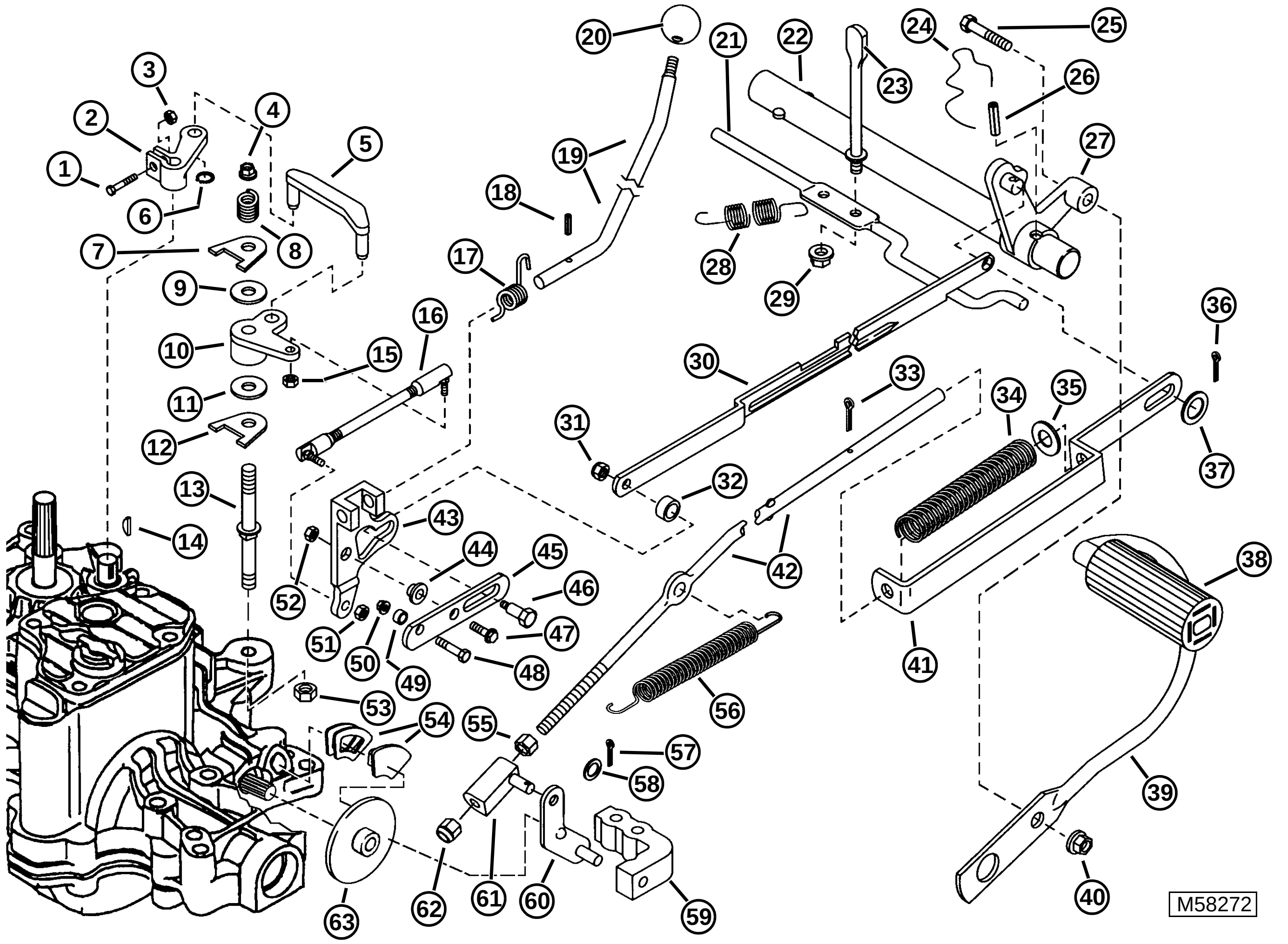
1. Remove mower deck.
2. Use this drawing for complete repair of system.

⚠ CAUTION

Large idler bellcrank spring is under high tension. Use locking pliers or spring puller tool and wear safety glasses and gloves when removing clutch bellcrank spring.

3. Install mower deck.

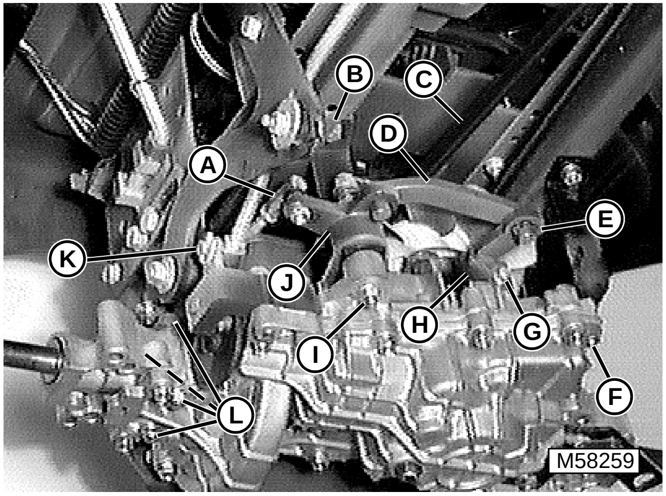
1-Cap screw (M6x20)
2-Shift arm
3-Lock nut (M6)
4-Lock nut (M10)
5-Shift link
6-Snap ring
7-Anchor washer
8-Spring
9-Friction disc
10-Bellcrank
11-Friction disc
12-Anchor washer
13-Stud (M10x76.5/M8x40)
14-Woodruff key (5/32x5/8 in.)
15-Lock nut (5/16 in.)
16-Turnbuckle
17-Return spring
18-Rolled pin (M4x20)
19-Shift lever
20-Shift knob
21-Park brake rod
22-Brake cross-shaft
23-Park brake lever
24-Safety wire
25-Cap screw (M8x35)
26-Rolled pin (M4x20)
27-Brake bellcrank
28-Spring
29-Flange nut (M6)
30-Neutral return strap
31-Flange nut (M10)
32-Bushing
33-Cotter pin (M3.2x20)
34-Compression spring
35-Washer
36-Cotter pin (M3.2x20)
37-Washer
38-Brake pedal pad
39-Brake pedal
40-Lock nut (M8)
41-Compression spring strap
42-Brake rod
43-Shift bracket
44-Bushing
45-Support strap
46-Shoulder bolt
47-Cap screw (M10x25)
48-Cap screw (M8x25)
49-Spacer
50-Flange nut (M8)
51-Lock nut
52-Flange nut (M10)
53-Flange nut
54-Friction puck and shims
55-Nut
56-Return spring
57-Cotter pin (M3.2x20)
58-Washer
59-Brake lever bracket
60-Brake lever
61-Brake adapter
62-Lock nut
63-Brake disc

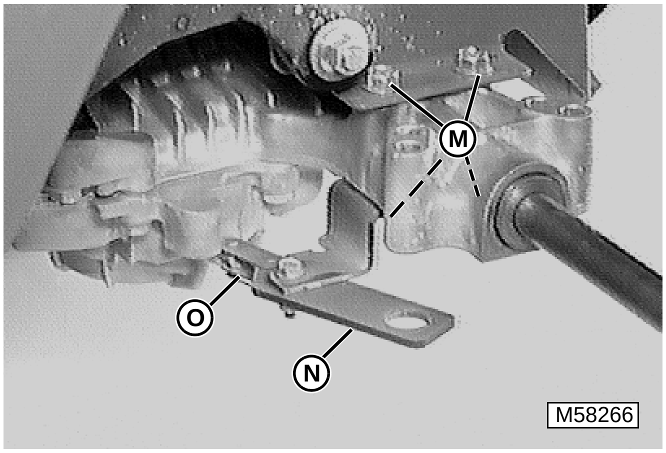


TRANSAXLE REMOVAL AND INSTALLATION

Removal

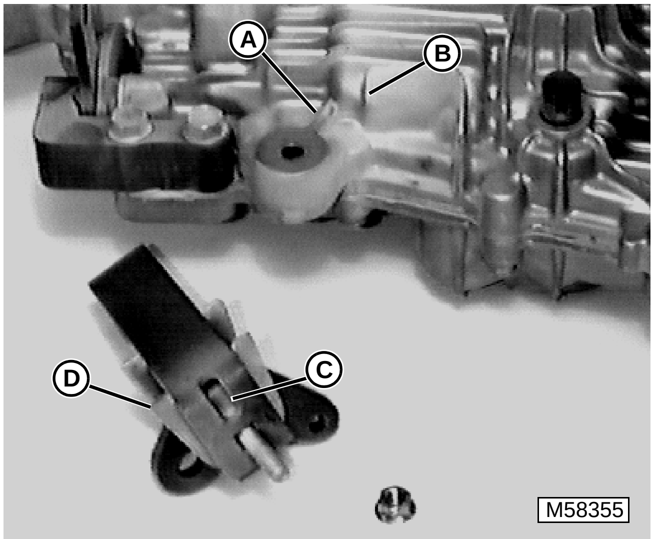
1. Safely raise and block rear of tractor off surface.
2. Safely support bottom of transaxle or have a helper hold transaxle in place when you remove final hardware (Steps 13—14).
3. Remove drive wheels, inspect key and keyways, washers, and snap rings. Replace as necessary.

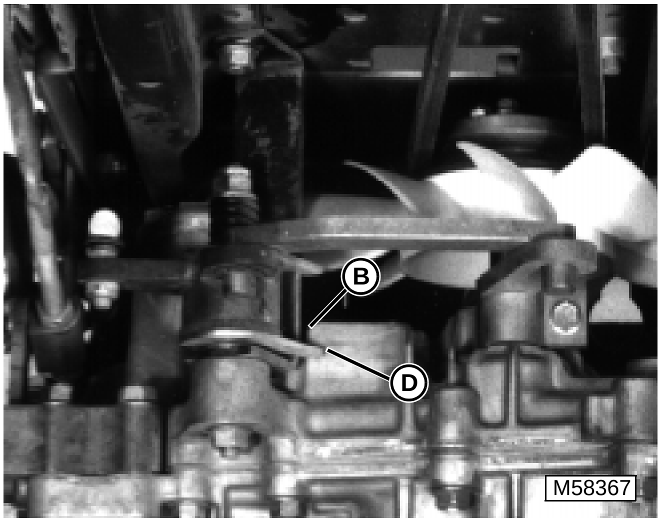




4. Remove traction drive belt (C) from drive sheave.
5. Disconnect shift linkage turnbuckle (A) from bellcrank assembly (J).
6. Remove cotter pin and washer (K) to disconnect brake rod from brake lever.
7. Remove chain link (O) from left-side transport valve assembly.
8. Remove left-front mounting bracket lower cap screw and flange nut (F).
9. Remove flange nut (B) from right-front mounting bracket.
10. Remove two right-side mounting cap screws and flange nuts (L).
11. Pull transport lever (N) into over-center position to remove two left-hand mounting cap screws and flange nuts (M).
12. Remove transaxle to workbench.
13. Remove snap ring (E) to remove shift link (D).
14. Remove cap screw and lock nut (G) to remove shift arm (H). Inspect woodruff key and keyways of shift arm and pump variable swashplate shifter shaft.
15. Remove flange nut (I) slowly to remove bellcrank assembly (J).
16. Drain oil from transaxle.

Installation





17. Make sure bellcrank assembly and transaxle right, front mounting bracket are oriented properly. Slot (C) should be aligned with transaxle housing rib (A) so that ear (D) of lower anchor washer **is not** wedged behind housing vertical rib (B).
18. Install transaxle in reverse order of removal.
19. Tighten mounting hardware to specifications.
20. Install traction drive belt.

Specification:

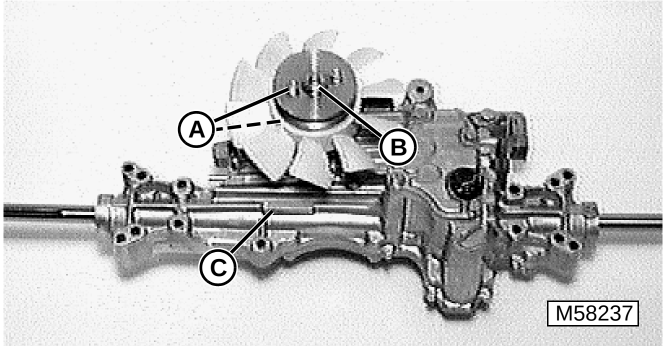
Flange nut to right-front mounting bracket
. . . . . 15 N•m (132 lb-in.)
Cap screw and nut to left-front mounting bracket
. . . . . 15 N•m (132 lb-in.)
Cap screws and nuts to frame
. . . . 20.3—47.4 N•m (180—420 lb-in.)
Shift arm cap screw and lock nut
. . . . 9.5—14.9 N•m (84—132 lb-in.)
Turnbuckle lock nut
. . . . 10.8—16.3 N•m (96—144 lb-in.)

IMPORTANT: To adjust entire traction drive system see tests and adjustments.

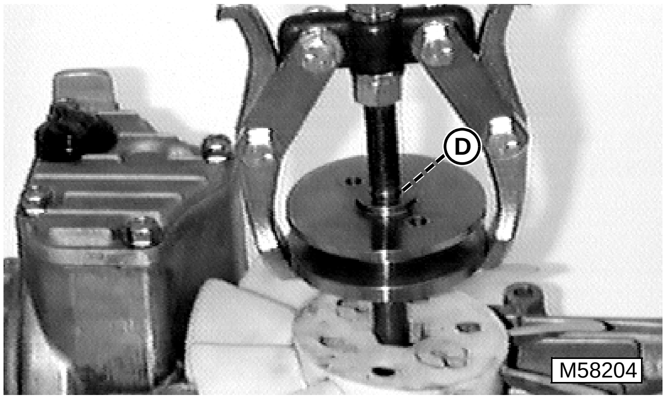
TRANSAXLE DISASSEMBLY

IMPORTANT: PAY CLOSE ATTENTION to the ORDER and ORIENTATION of ALL COMPONENTS to their neighboring components. Mark them, if necessary. This will help greatly when its assembly time.

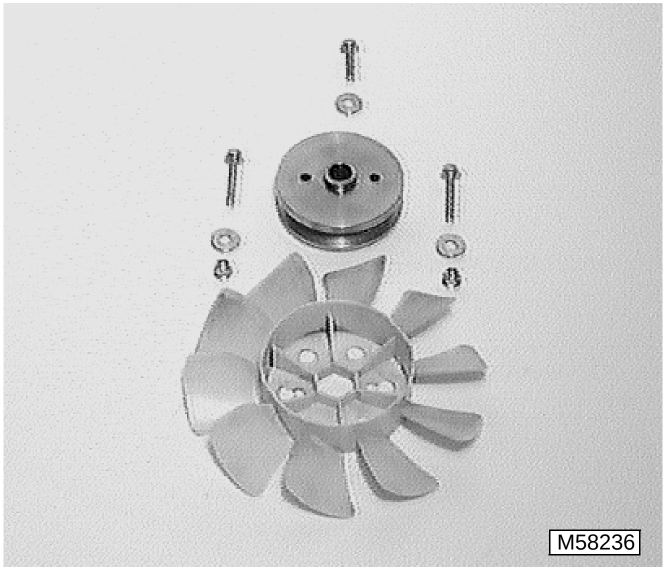
Remove Drive Sheave and Fan—



1. Thoroughly clean transaxle with approved solvent for aluminum castings and dry with compressed air.
2. Remove fan cap screws and flange nuts (A).
3. Remove cap screw and washer (B).
4. Reference transaxle serial number (C) whenever necessary.



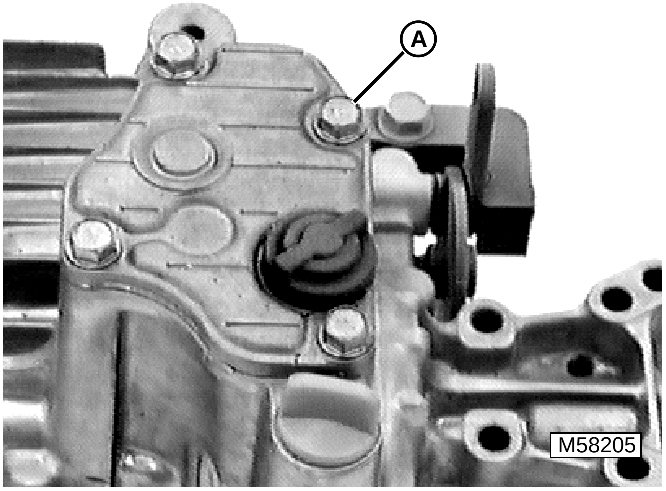
5. Install an 19m8334 (M6x1.0x30) socket head cap screw (D) from stock into end of pump (input) shaft—finger tight only.
6. Put puller on special screw and pull drive sheave from pump shaft.



7. Inspect drive sheave for damage, replace as necessary.
8. Remove fan and inspect for damage, replace as necessary.

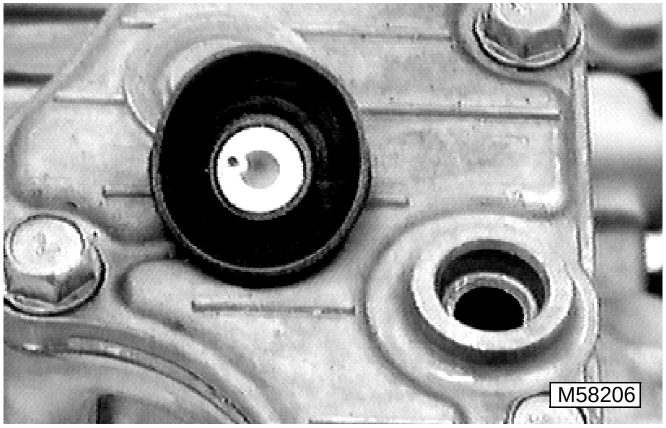
Remove Reservoir Cover—

NOTE: If there is no damage to cover or upper case housing, you need not remove cover because there are no components inside the reservoir.



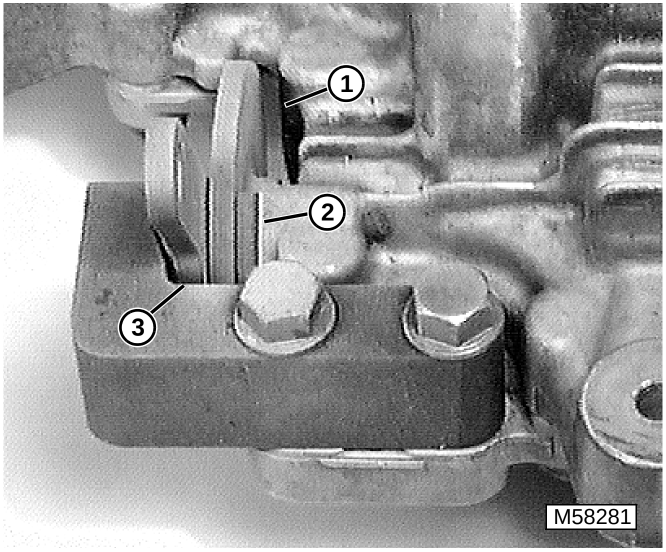
1. Remove four cap screws (A) to remove reservoir cover.
2. Inspect cover for cracks or holes, replace as necessary.
3. If cover is in good condition and to be reused, clean off all gasket residue and wipe clean, then set cover and four cap screws aside for final assembly.

Remove Breather Valve Assembly—

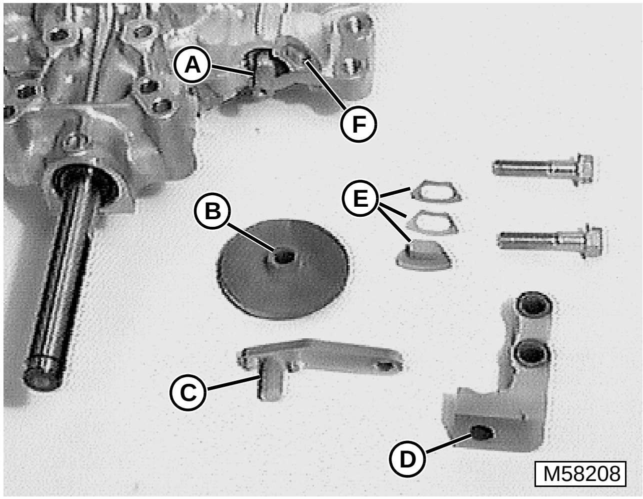


1. Pull breather valve assembly from reservoir cover.
2. Inspect condition of breather valve assembly, replace as necessary.

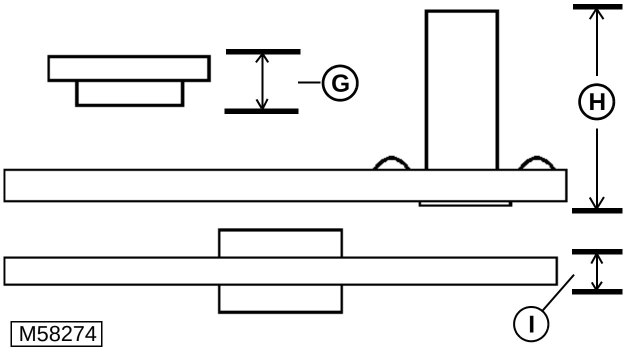
Remove Brake Assembly—



1. First, inspect brake assembly for wear or damage:
   - check for brake disc contact points at case points (1 and 2),
   - check for brake lever contact point at mounting bracket edge (3). If contact is detected, replace lever, disc, and friction puck **as a set**.



2. Remove two cap screws to remove brake assembly.
3. Inspect intermediate shaft brake splines (A) and brake disc splines (B) for chips, rust, and broken teeth. Replace as necessary.
4. Inspect mating surfaces of brake lever shaft (C) and mounting hole (D) for scoring, pitting, and wear. Replace as necessary.
5. Inspect mating surfaces of case recess (F) and friction puck and shims (E) for rust. Clean or replace as necessary.



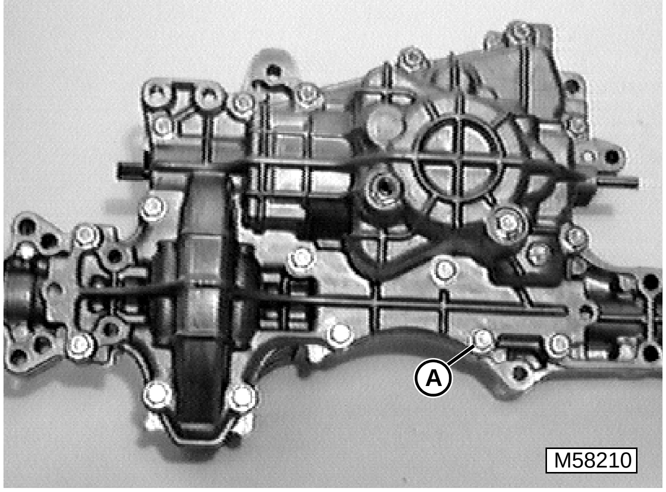
6. Measure brake components individually.
7. Replace components as necessary and **as a set only**. Set brake assembly components aside for final assembly. See page 6-46 Brake Pad Adjustment.

Specifications:

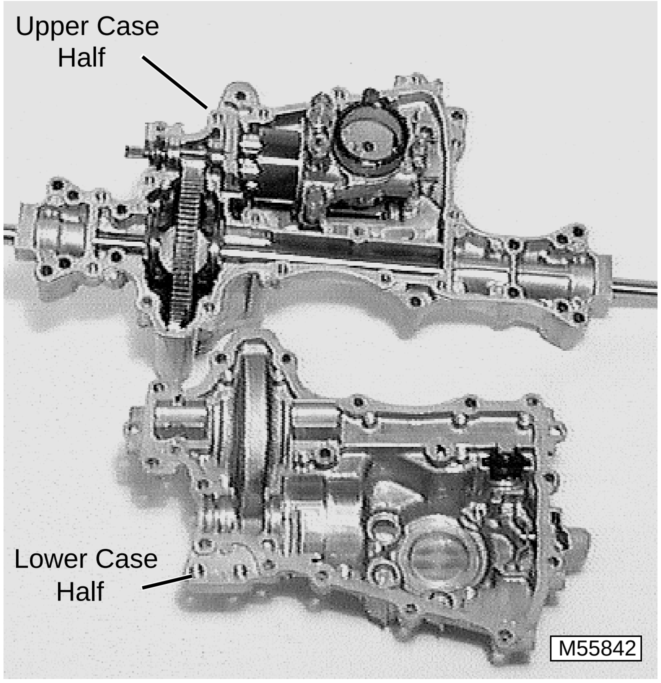
Brake Components Wear Tolerances—

(G) brake puck (minimum) . . . . 8 mm (0.3 in.)
(H) brake lever (minimum). . . . . . . 25 mm (1.0 in.)
(I) brake disc (minimum) . . . . . . 2.5 mm (.098 in.)

Separate Transaxle Housing Case Halves—



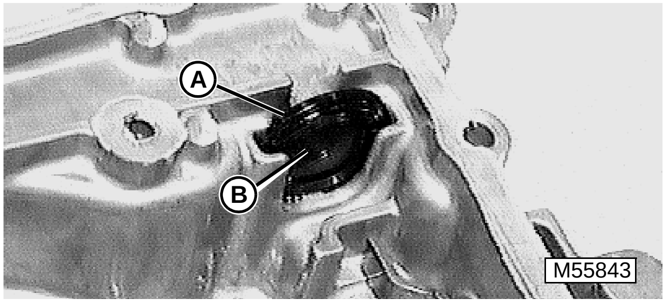
1. Remove seventeen transaxle housing cap screws (B).



K-50 Version Shown

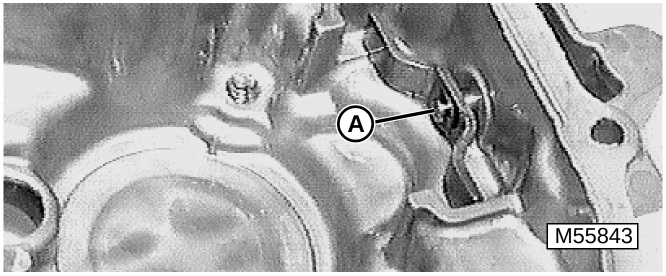
2. Carefully separate transaxle housing into upper and lower case halves.
3. Remove any gasket residue from both case halves.
4. Inspect overall condition of components without removing any of them. Visually target worn or damaged parts for replacement.
5. Remove any remaining oil without removing any components.

Clean and Inspect Magnet Assembly—

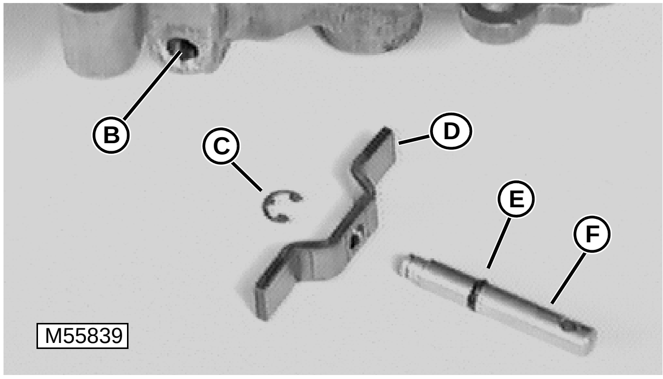


1. Pull magnet assembly from lower case half and clean thoroughly.
2. Replace complete assembly if rubber ring (A) is split or hard.
3. Test magnet (B) by holding a screw driver blade close to, it should readily draw the blade to it. If drawing force is weak, replace complete magnet assembly.
4. Set magnet assembly aside for final assembly.

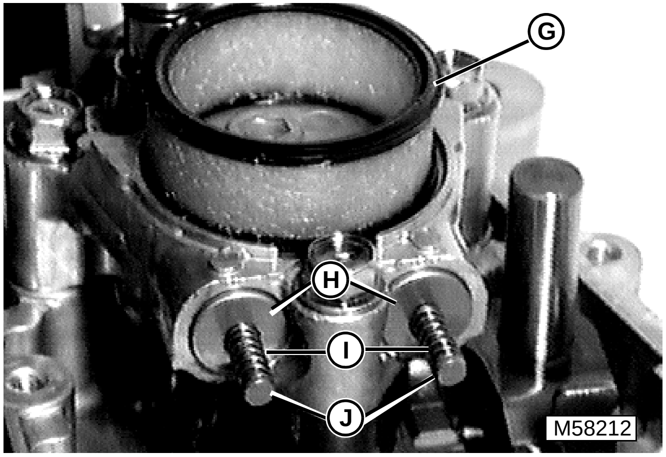
Disassemble Transport (Free-Wheeling) Assembly–



NOTE: *Inspect transport actuating bracket and pin assembly (A) for wear or leakage to outside. If assembly is in good condition, just set lower case half aside for final assembly.*

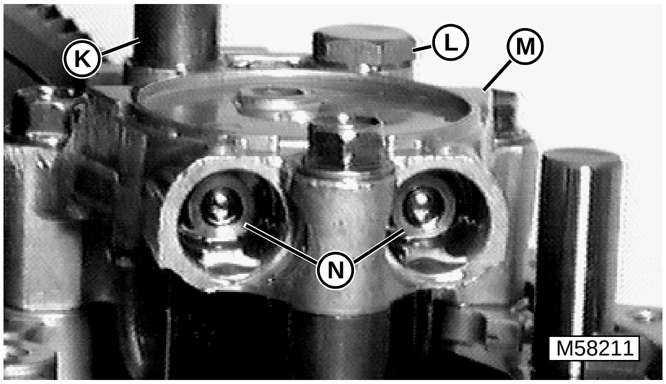


1. If wear or leakage is detected, remove e-ring (C), actuating bracket (D), and pin (F).
2. Remove and discard o-ring (E). Replace it with new o-ring every time assembly is removed or leaking.
3. Inspect pin (F) and lower case bore (B) for pitting, scoring, or rust. Replace as necessary.
4. Inspect e-ring (C) and bracket (D) for wear or deformity. Replace as necessary.



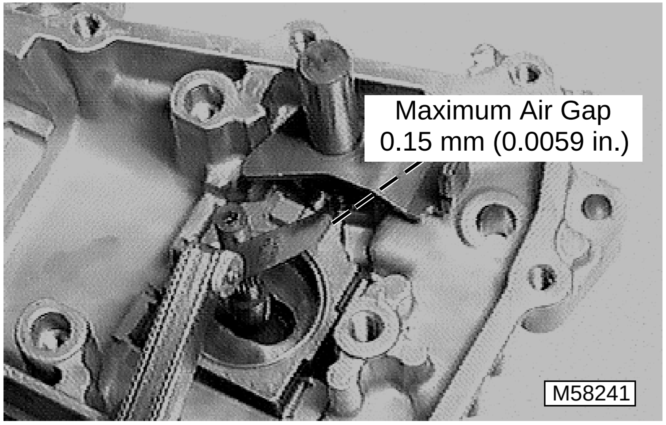
K-50 Version Shown

5. Remove and discard filter (G). Replace it with a new filter every time case halves are separated.
6. Remove and inspect push pins (J), springs (I), and push pin guides (H). Replace as necessary.

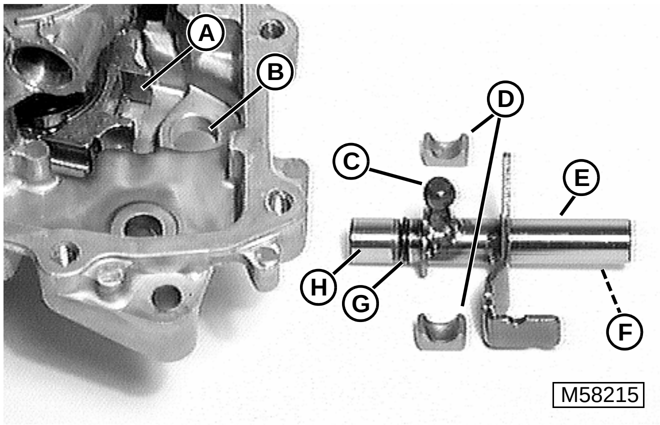


7. Inspect transport bypass relief valve body and balls (N) for pitting, scoring, discoloration, or damage.
8. If any detected, install brake disc on motor drive shaft splines and hold shop cloth over valve bores to catch valve bodies.
9. Turn brake disc clockwise to force one of valve assemblies (N) from center block (M), then turn brake disc counterclockwise to force other valve assembly from center block.
10. If valve assemblies do not dislodge, remove plug (L) and bleed port connector (K) and try using compressed air to dislodge valve assemblies.
11. If valve assemblies still remain lodged, depress check balls with extractor tool(s) to grab onto valve body and pull them from center block and discard valve bodies.
12. Check bores, if damaged—replace center block.

Disassemble Shifter Shaft Assembly—

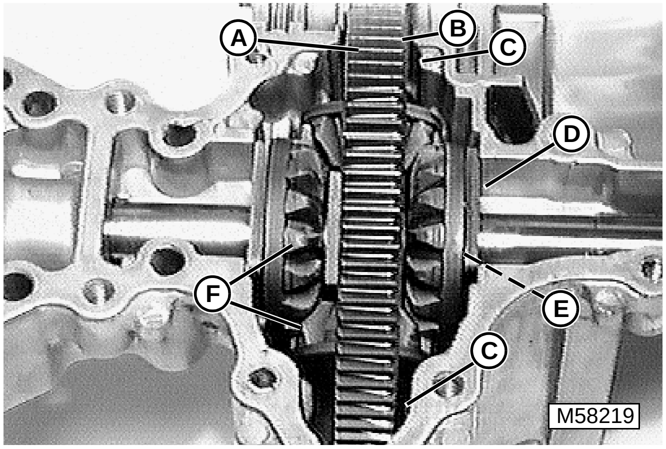


(Pump, motor, and center block removed for clarity)

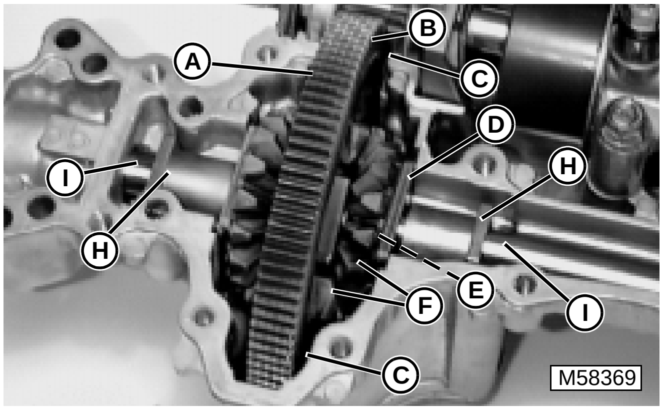


1. First, measure air gap between edge of swashplate slot (A) and shift blocks (D). If out-of-specification, replace shift blocks.
2. Lift shifter shaft assembly (E) and shift blocks (D) from upper case half mounting hole (B) and slot of swashplate (A).
3. Inspect mating surfaces of case hole (B) and end of shaft (H) for scoring or pitting. Replace as necessary.
4. Remove and discard o-ring (G). Replace o-ring every time shifter shaft is removed.
5. Inspect mating surfaces of shifter shaft ball joint (C) and shift blocks (D) for scoring or pitting. Replace as necessary.
6. Inspect shifter shaft keyway (E) for chips or wear. Replace shifter shaft as necessary.

Inspect Differential Axle Assembly—



K-50 Version

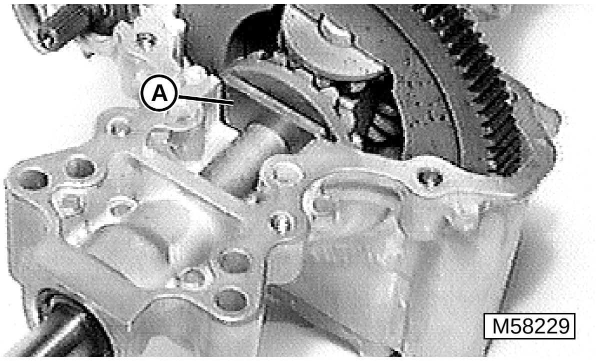


K-55 Version

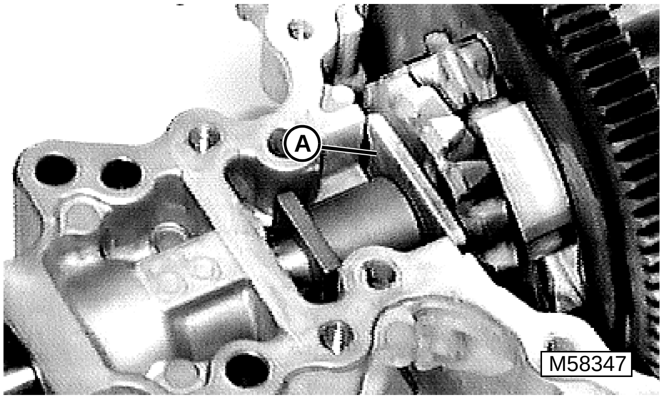
1. Visually inspect assembly:

- ring gear teeth (A) are all in good condition;
- sides of ring gear (B) are not contacting walls of case half (C);
- thrust plates (D) are holding assembly in proper alignment;
- axle shafts and bevel gear splines (E) instantly and smoothly turn differential bevel gears;
- bevel gears (F) are all in good condition;
- K-55 axle shaft bushings (H) are both in good condition;
- axle shafts (I) are both in good condition;
- area is free of metal chips or shavings.

DIFFERENTIAL AXLE—DISASSEMBLY

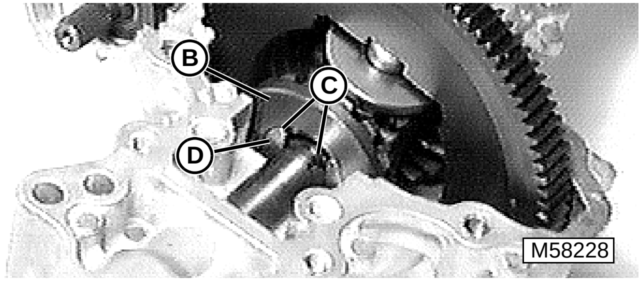


K-50 Short Axle Side

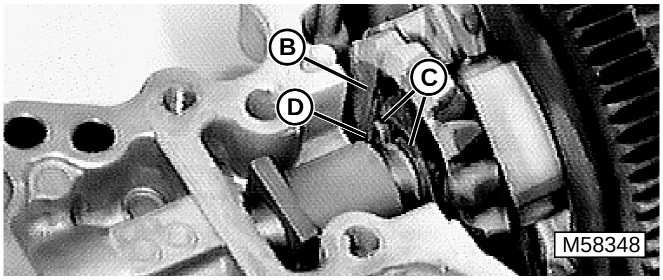


K-55 Short Axle Side

1. Remove short axle side thrust washer (A).

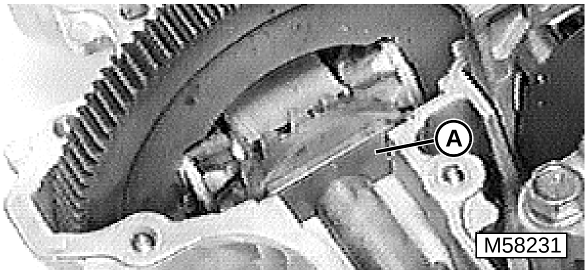


K-50 Short Axle Side

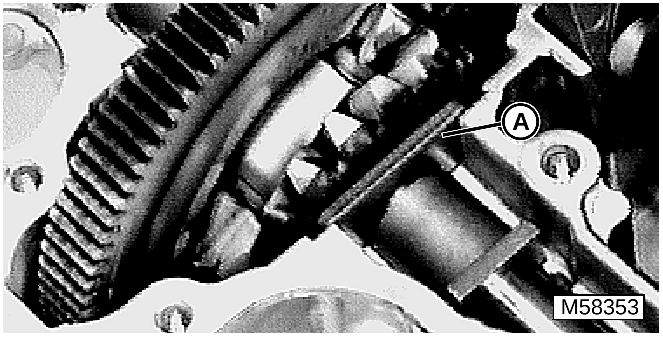


K-55 Short Axle Side

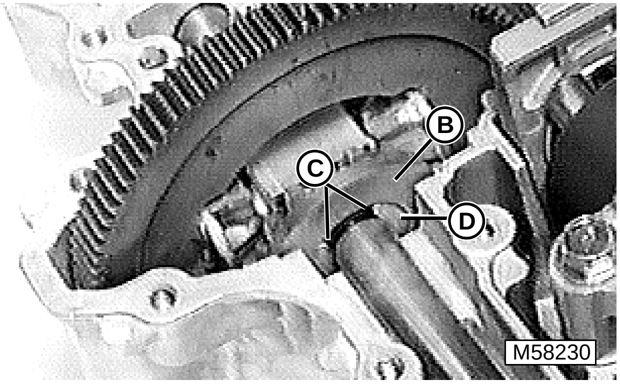
2. Turn c-ring (D) in its groove so gap (C) faces down to keep c-ring from falling down inside case.
3. Carefully slide short axle outward slightly while holding axle bevel gear (B) stationary, just enough to expose c-ring (D).
4. Carefully lift c-ring (D) from axle. **DO NOT** remove axle, this will hold bevel gear (B) in place while long axle side is disassembled.



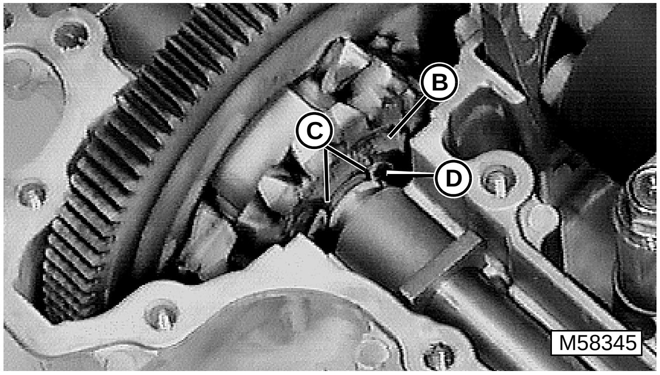
K-50 Long Axle Side



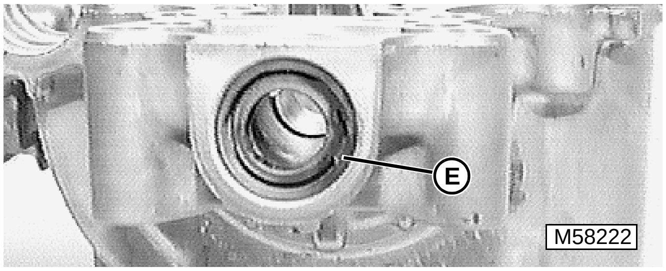
K-55 Long Axle Side



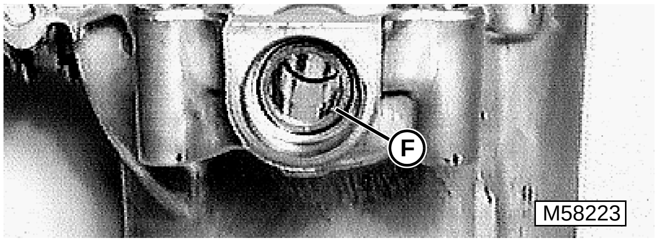
K-50 Long Axle Side

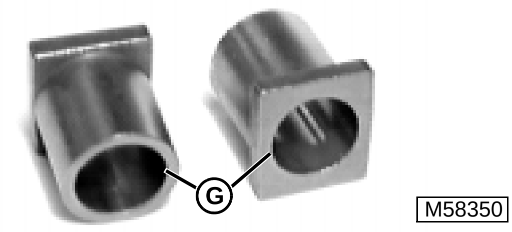


5. Repeat Steps 1—4 for long axle side.
6. Grab entire differential gear assembly by both axle bevel gears (B) and slide each axle clear to remove gear assembly.
7. Remove both axles and axle bushings (K-55 version only).



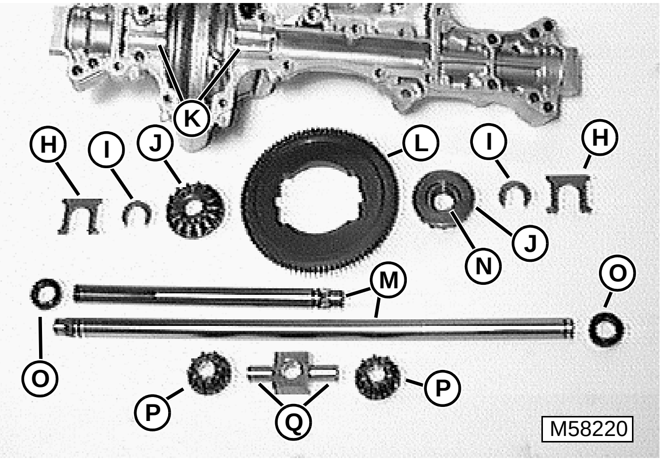
8. Remove and discard axle seals (E) from both sides. Replace with new seals every time axles are removed.



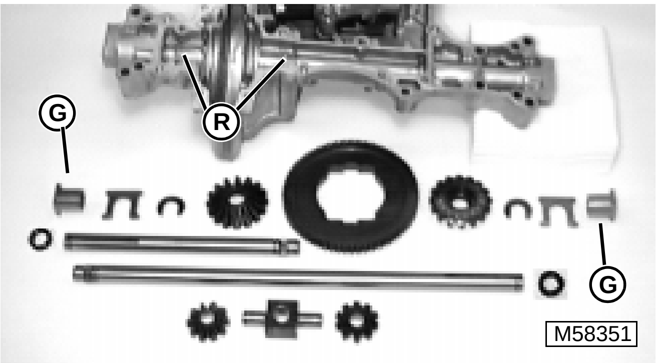


K-55 Inner Axle Bushings

9. Inspect upper case half outer left and right axle bushings for scoring, pitting, wear, or discoloration.
10. Measure inside diameter of bushings (F) and K-55 inner left and right axle bushings (G).
11. If bushings exceed specification, replace upper case half (outer bushings are not serviced) and both K-55 inner axle bushings, replace as a set only.



K-50 Version



K-55 Version

NOTE: One of the main differences in the K-55 version from the K-50 version are the two inner axle bushings (G) and their seat grooves (R).

12. Inspect thrust washers (H), c-rings (I), and bevel gear (J) recess surfaces (N) for scoring, pitting, or wear.
13. Inspect axle bevel gears (J) for wear, scoring, pitting, chipped or broken teeth, and worn, chipped, or broken splines. Gears should have 16 teeth.
14. Inspect differential ring gear (L) for wear, scoring, pitting, chipped or broken teeth, and cross-shaft notch wear. Ring gear should have 98 teeth.
15. Inspect differential cross-shaft (Q) and bevel gears (P) for wear, scoring, pitting, discoloration, and chipped or broken teeth. Gears should have 10 teeth. Measure inside diameter of gears and outside diameter of cross-shaft.
16. Inspect axle shafts for scoring, pitting, discoloration, damaged c-ring and snap ring grooves, damaged keyways, and chipped or broken splines. Measure axles outside diameters.
17. Replace components as necessary.

IMPORTANT: Axle shaft seals (O) must be replaced every time axles are remove. Protect new seals by wrapping tape over splines and c-ring grooves of axle shafts before assembly.

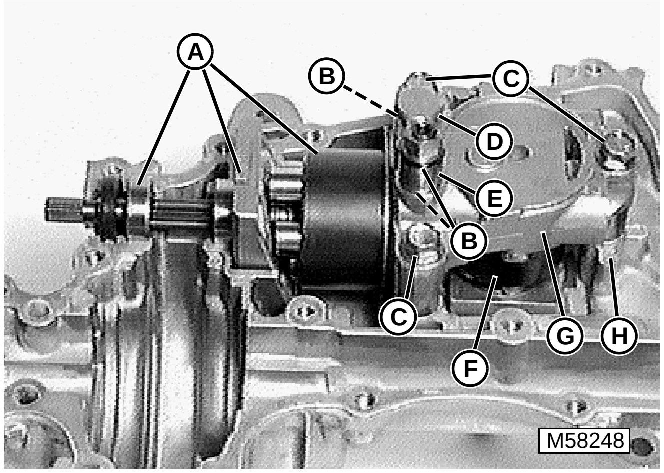
18. Inspect upper case journals (K) and K-55 extra bushings seat grooves (R) for excessive wear, scoring, pitting, or discoloration. Replace as necessary.

Specifications:

Bushing ID (maximum)	**19.2 mm (0.76 in.)**
Bevel gears ID (maximum)	**15.11 mm (0.60 in.)**
Cross-shaft OD (minimum)	**14.96 mm (0.589 in.)**
Axles OD (minimum)	**19 mm (0.748 in.)**

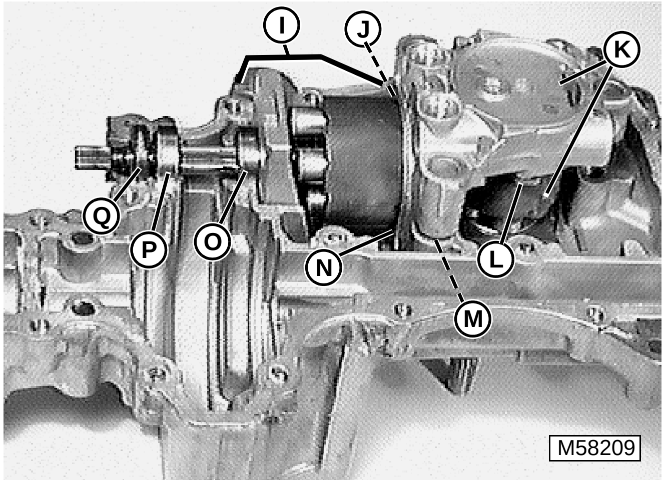
PUMP, MOTOR, AND CENTER BLOCK—DISASSEMBLY

**IMPORTANT: Loss of Hydro Power—
STX38 (M00STXC210001—270000)
STX38 (M00STXJ270001—290000)
STX46 (M00STXG240001—270000)
STX46 (M00STXL270001—290000) One or more piston springs may be missing in the pump or motor cylinder block. With the spring missing, piston washer may slip out of piston and damage surfaces of the cylinder blocks, plates, and center block.**



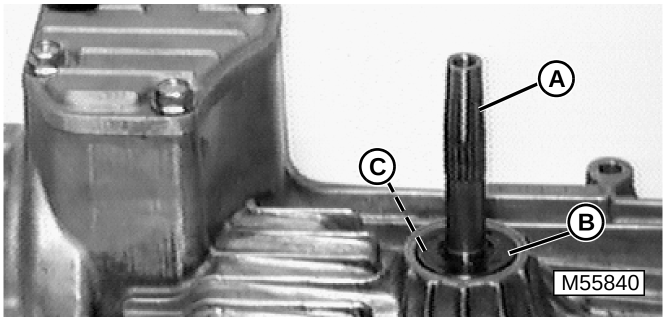
IMPORTANT: READ THIS PROCEDURE COMPLETELY BEFORE PROCEEDING. Pump, motor, and center block assembly is under CONSIDERABLE PRESSURE. Do not allow assembly to FLY APART or damage may occur to many finely-polished, machined components. PAY CLOSE ATTENTION to the ORDER and ORIENTATION of ALL COMPONENTS to their neighboring components. Mark them, if necessary. This will help greatly when its assembly time.

1. Visually check overall condition of assembly, without removing any components. Look for scoring, pitting, discoloration, worn or broken teeth or splines, or other detectable damage.
2. Remove port plug (D) and connector (E). Remove and discard three o-rings (B). Replace o-rings every time port plug and connector are remove.
3. Hold downward on entire pump (F), motor (A), and center block (G) assembly with one hand as you gradually loosen three cap screws (C) with the other.
4. Keeping downward pressure steady, slowly remove three cap screws (C) and spacer (H).

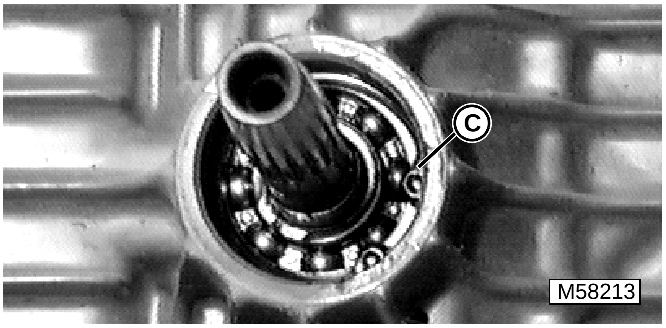


5. Without losing any pressure; reposition both hands, one over the motor portion (I) and one over pump and center block portion (K).
6. Now compress both portions together a little more to allow you to walk rolled pins (M) and entire assembly from upper case. Maintain pressure so you do not scratch mating surfaces of motor cylinder block (J) and finished-brass motor plate (N) and pump cylinder block and its plate (L). Also, do not scratch bearing races (O and P) on case grooves while walking assembly from upper case.
7. Carefully move and separate motor, pump, and center block assembly to workbench.

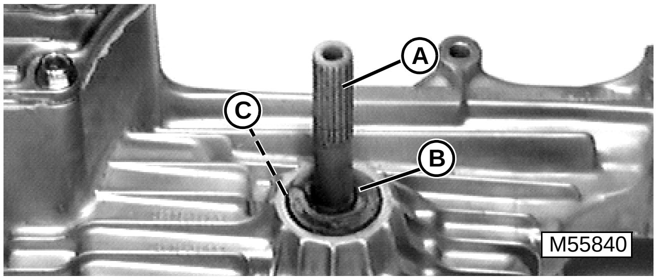
Remove Pump Input Shaft Assembly—



K-50 Version



K-50 Version



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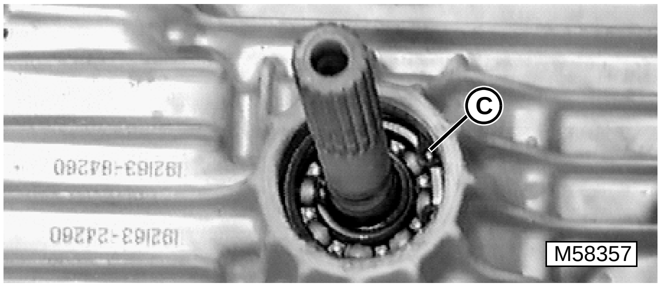
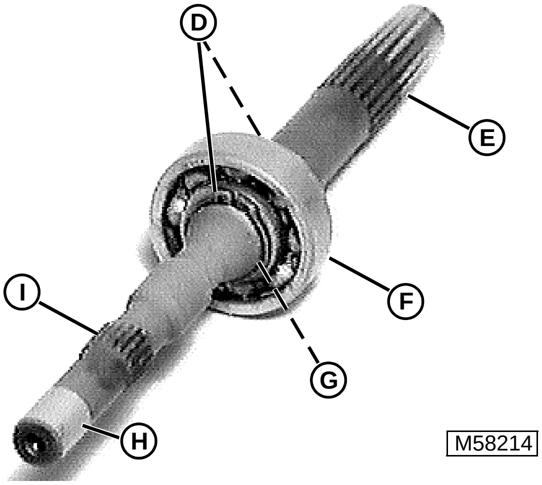


K-55 Version

IMPORTANT: Carefully remove components so case bore is not damaged.

1. Remove and discard shaft seal (B).
2. Remove snap ring (C) and pump shaft assembly (A).



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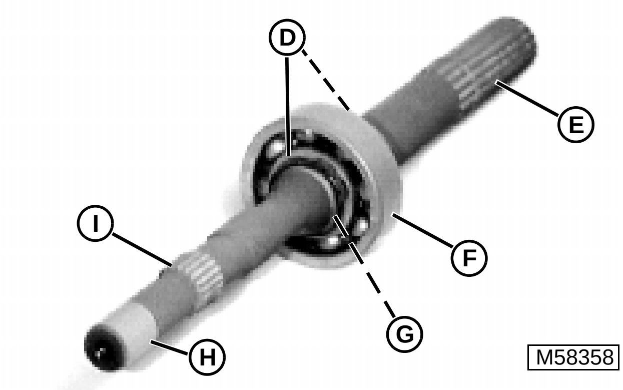
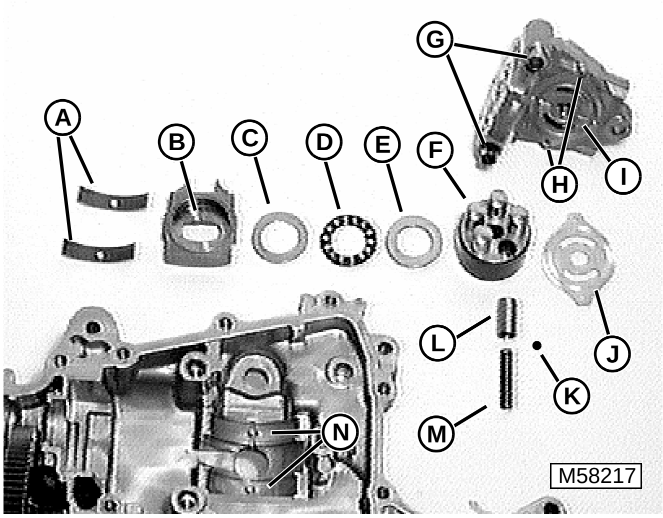


K-55 Version

3. Inspect ball bearing (F) for scoring, pitting, discoloration, and other wear.
4. If damaged, remove two snap rings (D) to remove and replace bearing.
5. Inspect splines (E and I) for chipped or broken teeth and machined surfaces (G and H) for scoring, pitting, discoloration, and other wear. Replace shaft as necessary and assemble in reverse order.

Disassemble and Inspect Pump and Swashplate—



IMPORTANT: PAY CLOSE ATTENTION to the ORDER and ORIENTATION of ALL COMPONENTS to their neighboring components. Mark them, if necessary. This will help greatly during assembly.

1. Carefully separate pump and swashplate components.
2. Clean and inspect components individually once disassembled:

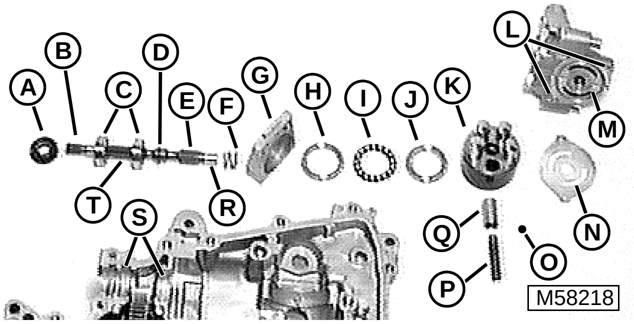
- thrust bushings (A) should not be scored, pitted, or worn badly—measure thickness:

Thrust bushings thickness
Minimum . . . . 1.3 mm (0.05 in.)

- swashplate (B) machine surfaces of ramps and bearing recess and bushing should not scored, pitted, discolored, or worn badly
- swashplate roller bearing (C, D, and E) should not be scored, pitted, discolored, missing any rollers, or roller retainer broken
- pump cylinder block (F), pistons (L), washers (K), and springs (M) must have free movement and should not be scored, pitted, discolored, distorted, or worn
- **bronze pump plate (J) and mating surface of cylinder block (F) should not be grooved, discolored, or worn thin around ports**;
- center block machined surface (I) should not scored, pitted, or discolored
- center block rolled pins (G) and dowel pins (H) should be in good condition, not missing or sheared off
- upper case ramps and centering pins (N) should be in good condition.

IMPORTANT: If thrust bushings and swashplate ramps are damaged, they must be replaced as a set. If swashplate recess machined surface or bushing are damaged, replace with new swashplate (bushing is not serviced separately). If bronze pump plate or center block are damaged, they both must be replaced. If any component of pump cylinder block is damaged, a complete new pump cylinder block must be ordered.

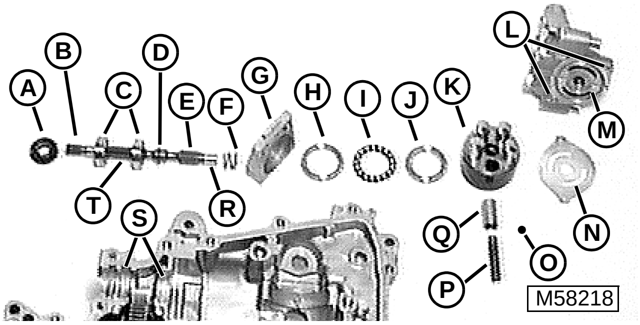
Disassemble and Inspect Motor and Drive Shaft—



IMPORTANT: PAY CLOSE ATTENTION to the ORDER and ORIENTATION of ALL COMPONENTS to their neighboring components. Mark them, if necessary. This will help greatly during assembly.

1. Carefully separate motor and drive shaft components.
2. Clean and inspect components individually once disassembled.

- drive shaft seal must be replaced every time drive shaft is removed or case halves separated
- drive shaft splines (B and E) should be in good condition, not chipped, broken, or worn
- drive shaft ball bearings (C) should not be scored, pitted, loose, or discolored;
- drive shaft snap ring (D) should be in good condition as should its groove
- drive shaft machined surface (R) should not be scored, pitted, or worn
- drive shaft spur gears (T) should have 6 teeth, not be scored, pitted, discolored, chipped or broken, nor worn thin
- drive shaft-to-cylinder block spring (F) should be in good condition, not weak, broken, nor distorted



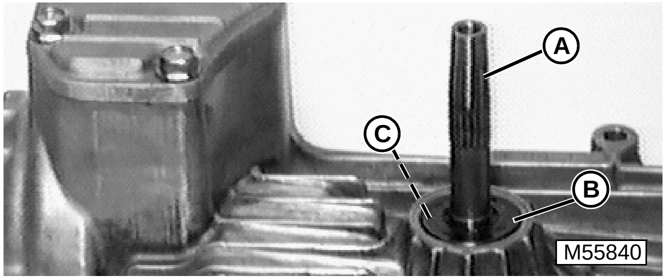
- motor fixed swashplate (G) should be in good condition, bearing recess machined surface should not be scored, pitted, discolored, nor worn badly;
- motor fixed swashplate ball bearing and thrust washers (H, I, and J) should not be scored, pitted, discolored, missing any balls, or ball retainer broken;
- motor cylinder block (K), pistons (Q), washers (O), and springs (P) must have free movement and should not be scored, pitted, discolored, distorted, or worn;
- **bronze motor plate (N) and mating surface of cylinder block (K) should not be grooved, discolored, or worn thin around ports**;
- center block machined surface (M) should not scored, pitted, or discolored;
- center block dowel pins (L) should be in good condition, not missing or sheared off;
- upper case drive shaft ball bearing grooves (S) should be in good condition, not scored, pitted, or discolored.

IMPORTANT: If fixed swashplate bearing components are damaged, they must be replaced as a set. If bronze motor plate or center block are damaged, they both must be replaced. If any component of motor cylinder block is damaged, a complete new motor cylinder block must be ordered. If upper or lower case halves show wear or damage, they need not be ordered as a set unless wear or damage is severe enough.

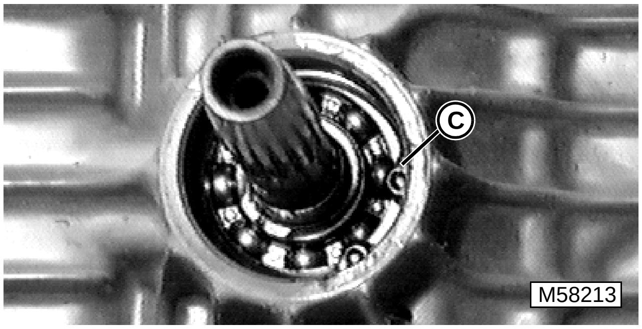
TRANSAXLE ASSEMBLY

IMPORTANT: Coat all components lightly with fresh oil before assembly, especially any mating surfaces between components.

Assemble and Install Pump Shaft Assembly—



K-50 Version



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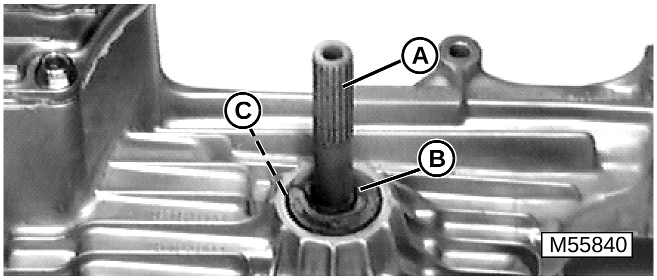

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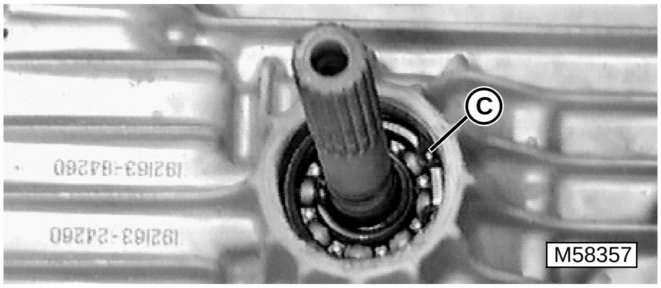


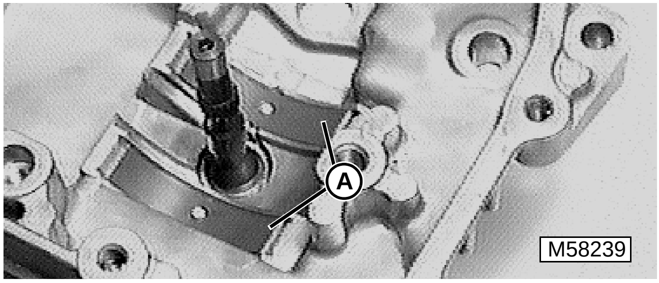
K-55 Version

IMPORTANT: Carefully install pump shaft assembly so case bore is not damaged.

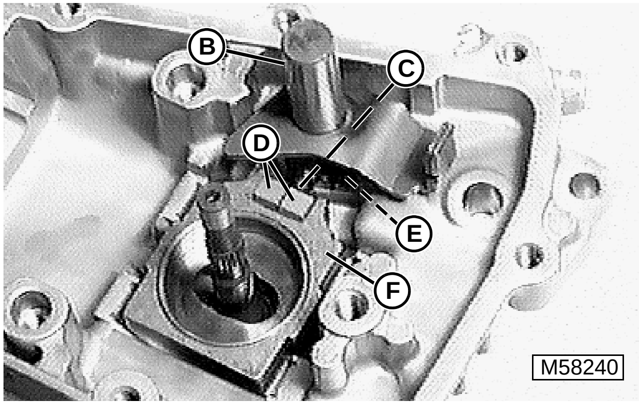
1. Assemble pump (input) shaft and carefully install it into upper case with snap ring (C).
2. Wrap tape around shaft splines (A) to protect seal.
3. Apply grease to lip surfaces of seal (B) before installing it flush with case lip.

Install Pump, Swashplate, and Shifter Shaft Assemblies—

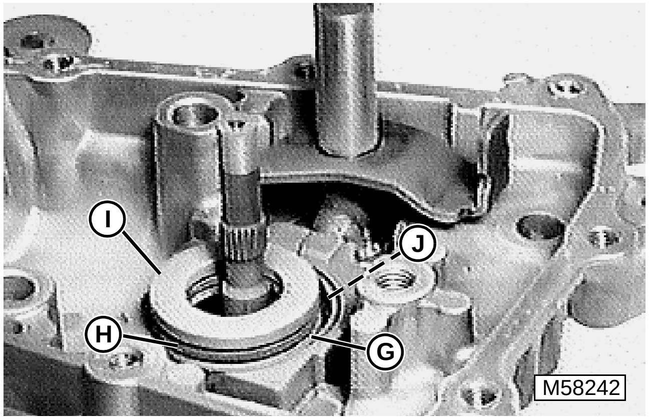
IMPORTANT: Read these next four procedures completely before proceeding.



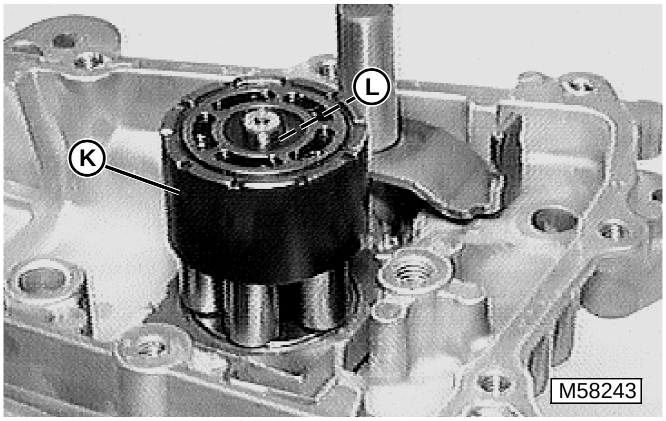
1. Install swashplate thrust plates (A).



2. Install new o-ring (E) on shifter shaft.
3. Install swashplate (F), shift blocks (D) (apply grease to help hold blocks in place), ball joint (C), and shifter shaft (B) together.



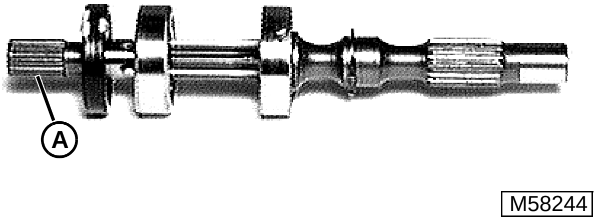
4. Install thin bearing thrust washer (G) first, ball bearing (H), and thick bearing thrust washer (I) on top (mates with pump pistons) into swashplate (J).



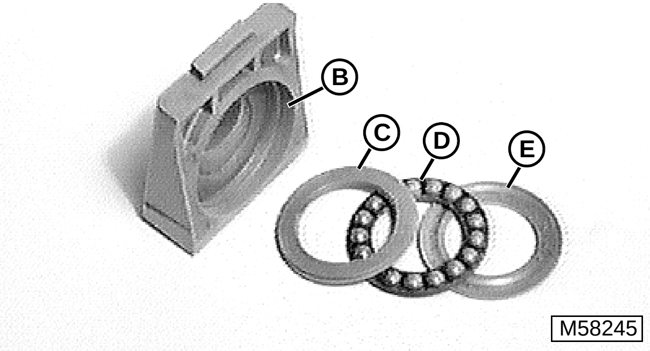
IMPORTANT: Hold fingers tightly between all five pistons so pistons don't drop out of cylinder block during assembly and spline alignment.

5. Install pump cylinder block assembly (K) over pump shaft, twisting left or right until splines of cylinder block align with shaft splines (L), and on top of swashplate bearing assembly.
6. Push on pump cylinder block a few times to ensure assembly is properly installed and has smooth movement and good spring tension.

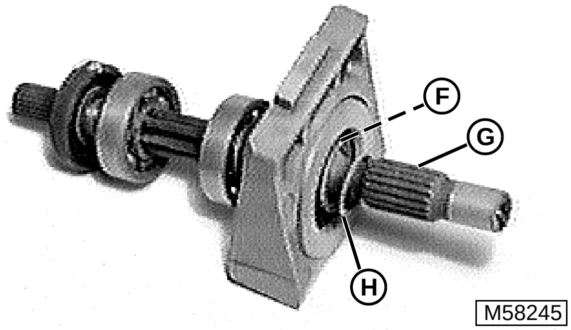
Install Motor and Drive Shaft Assembly—



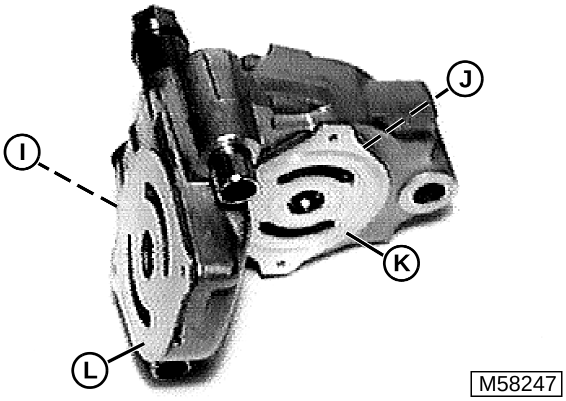
1. Assemble motor drive shaft.
2. Wrap tape over brake disc splines (A) before installing new seal with open lip to inside. Remove tape once seal is installed.



3. Install narrow thrust washer (C) into fixed swashplate recess (B) first, then ball bearing (D), and wide thrust washer (E) last (mates with motor pistons).

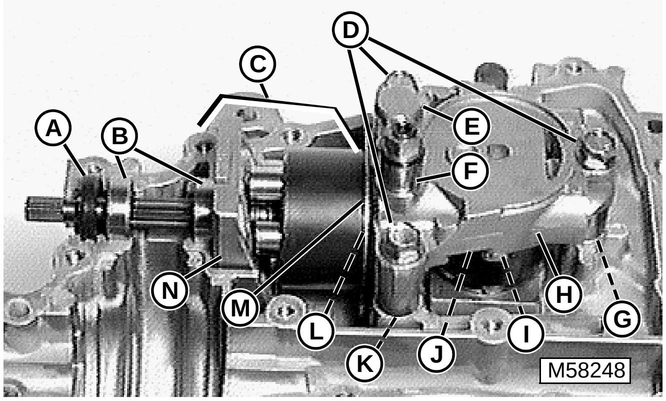


4. Install motor drive shaft assembly with longer cylinder block splines (G), spring (H), and snap ring (F) through fixed swashplate hole as shown.



5. Coat motor (I) and pump (J) machined surfaces of center block and backside of bronze motor (L) and pump (K) plates with grease to hold bronze plates in place.
6. Install motor (L) and pump (K) plates with bronze side facing away from center block.

Install Pump, Motor, and Center Block Assembly—



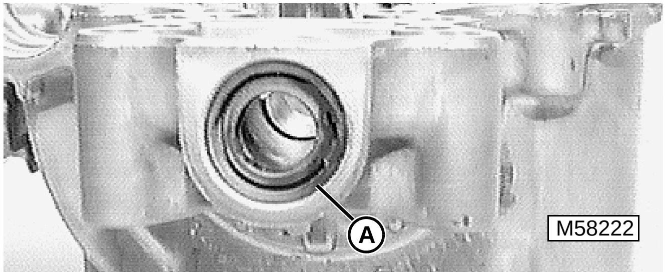
1. Assemble motor cylinder block and drive shaft assembly (C) to center block. **DO NOT scratch surface of bronze plate (M) with machined surface of cylinder block or with end of drive shaft (L)**.
2. Watch to see that end of pump shaft (J) is aligned with bronze plate center hole (I) as you execute Step 3.
3. At a slight angle, align seal (A), ball bearings (B), and fixed swashplate body (N) (with thick portion down) with upper case grooves and, at the same time, align two center block rolled pins (K) with case mounting holes as you squeeze center block and motor assemblies together.
4. Once rolled pins (K) are started, install center two cap screws (D) into rolled pin holes and turn finger tight only.
5. Install spacer (G) and right (third) cap screw (D) and turn finger tight.
6. Check assembly closely to ensure everything is aligned properly then tighten three caps screws to specification.

Specification:

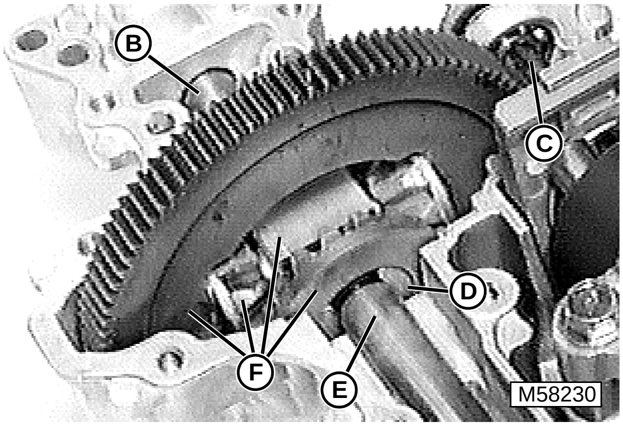
Center block cap screws

. . . . 44—58 N•m (391—520 lb-in.).

Install Differential Axle Assembly—

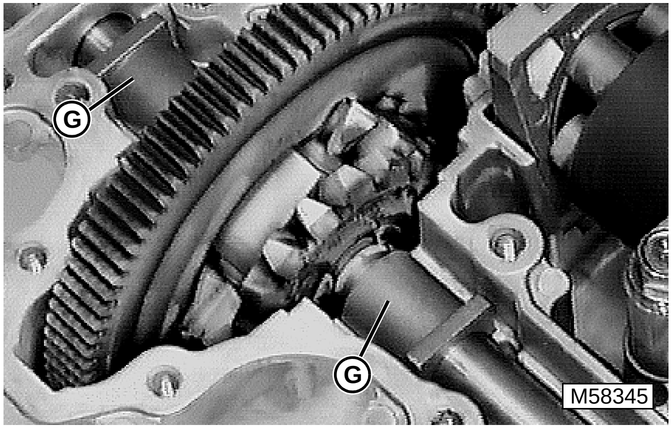


1. Apply grease to new axle seals (A) and install them into each end so they are flush with outside case lip and open side of seals to inside.



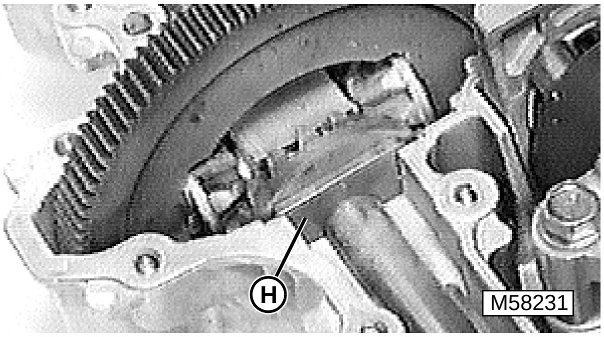
2. Wrap tape around short (B) and long (E) axle shaft splines and c-ring grooves to protect new seals.

K-50 Long Axle Side

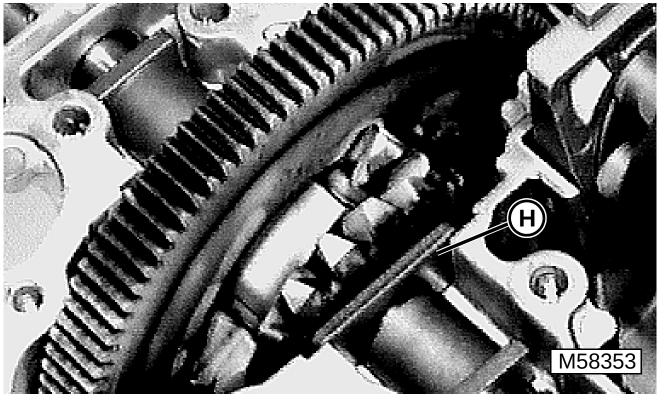


K-55 Long Axle Side

3. Install axle shafts through seals and bushings, then remove tape, and slide them up to differential cavity. On K-55 transaxles only, install additional inner bushings (G) and slide axle shafts flush with inside edge of bushings.
4. Assemble and hold differential cross-shaft, bevel gears, and ring gear assembly (F) together as you align it with motor drive shaft spur gears (C) and axle shafts (B and E).
5. Slide axle shafts into their bevel gears and retain them with c-ring (D).

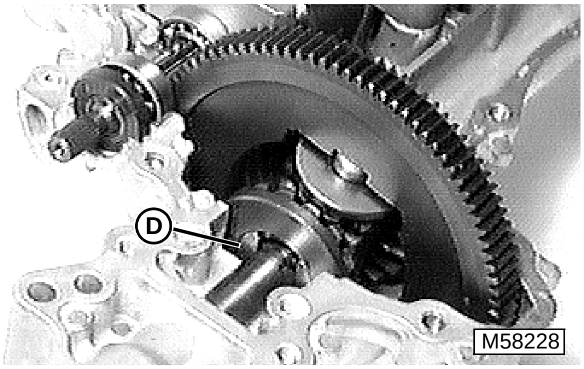


K-50 Long Axle Side

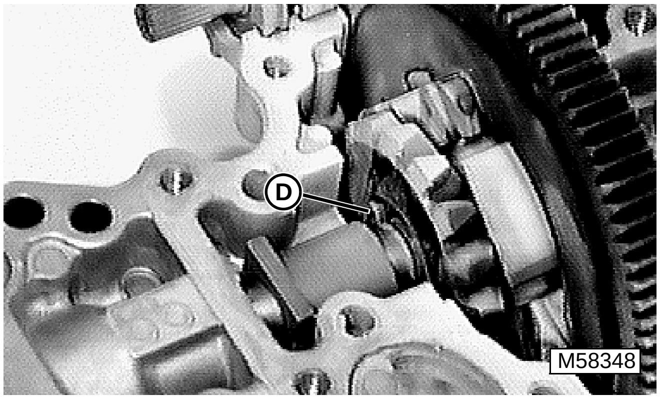


K-55 Long Axle Side

6. Install thrust washer (H).

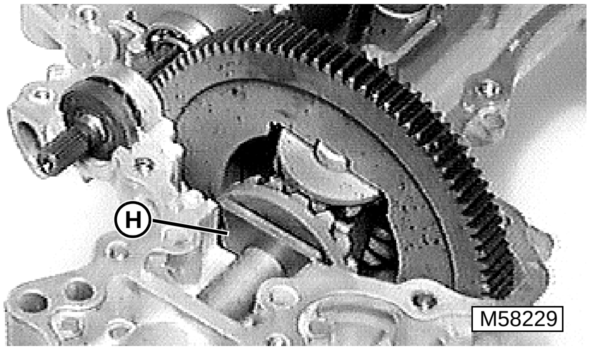


K-50 Short Axle Side

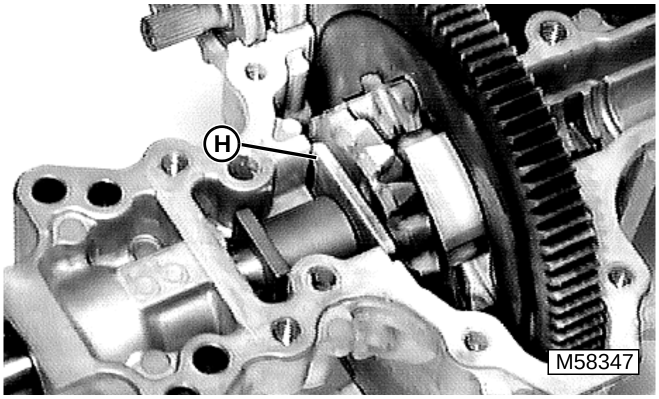


K-55 Short Axle Side

7. Repeat c-ring (D) procedures for short axle side.



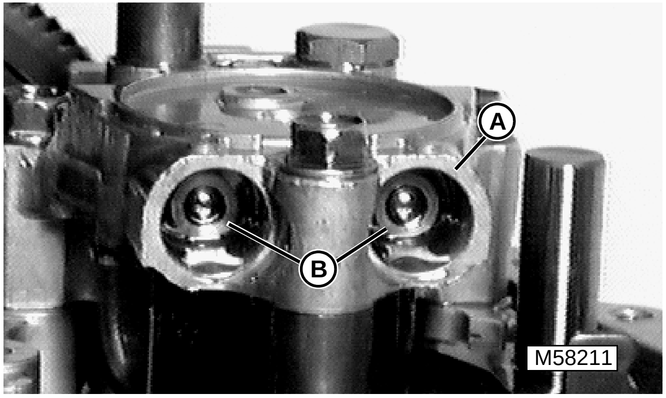
K-50 Short Axle Side



K-55 Short Axle Side

8. Repeat thrust washer procedures for short axle side.

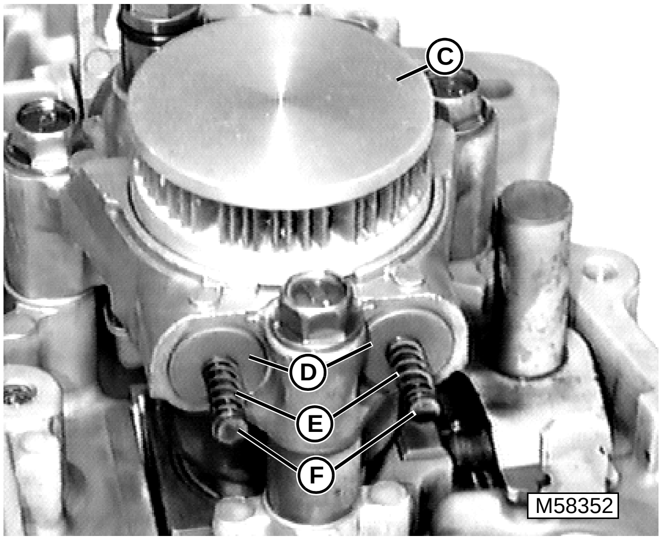
Install Filter, Magnet, and Transport (Free-Wheeling) Assembly—



1. Carefully install new relief valve assemblies (B) to specification into center block bores (A).

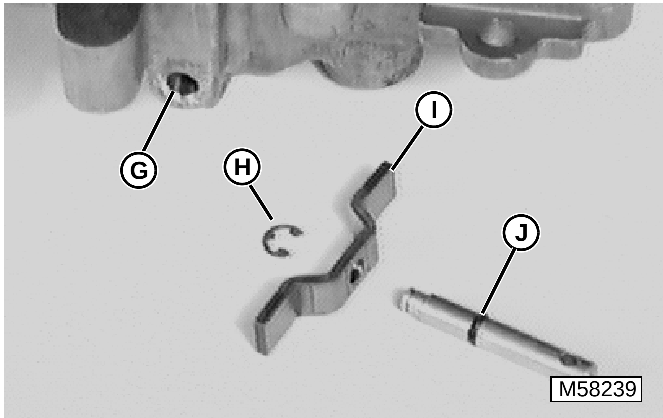
Specification:

Transport relief valve assemblies
. . . . approximately 13 mm (0.51 in.)

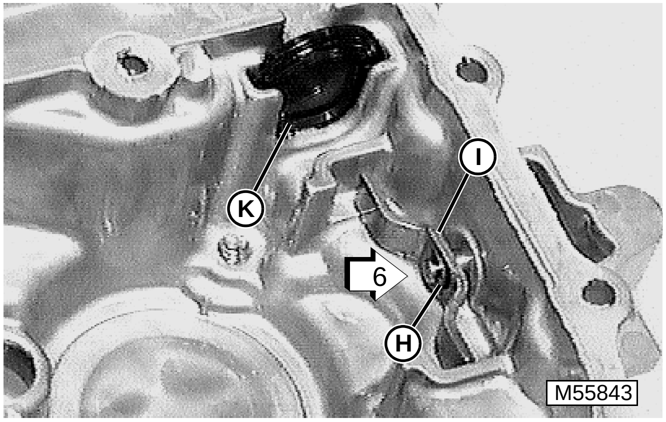


K-55 Version Shown

2. Install new filter (C).
3. Install bypass valve push pin guides (D), springs (E), and push pins (F).

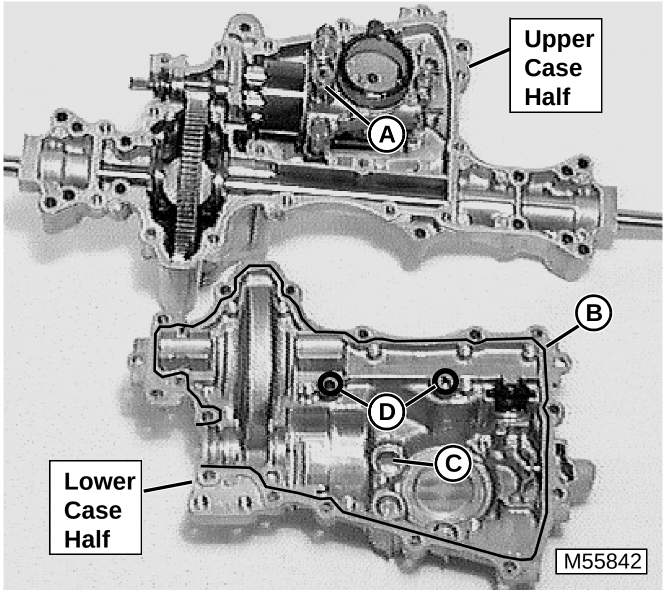


4. Install new o-ring (J) on actuating pin and install in lower case half bore (G).



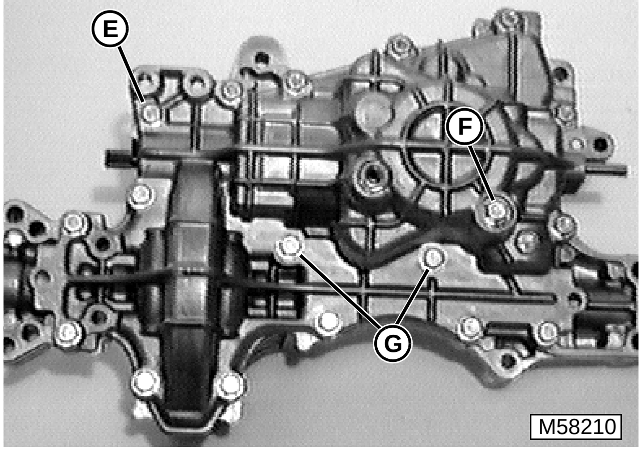
5. Fasten actuating bracket (I) with e-ring (H).
6. Be sure assembly is pushed all-the-way out before assembling transaxle case halves.
7. Install clean or new magnet assembly (K).

TRANSAXLE CASE HALVES—ASSEMBLY



K-50 Version Shown

1. Make sure mating surfaces of transaxle case halves are clean.
2. Apply a solid bead (B) of John Deere Form-In-Place Silicone Gasket Sealant around lower case half. Be sure to stay to the inside of the mounting holes.
3. Be sure to apply a solid bead around two inner holes (D).
4. Align hole (C) with bleed port stack (A) and firmly push lower case half onto upper case half.
5. Align all 17 case halves holes.

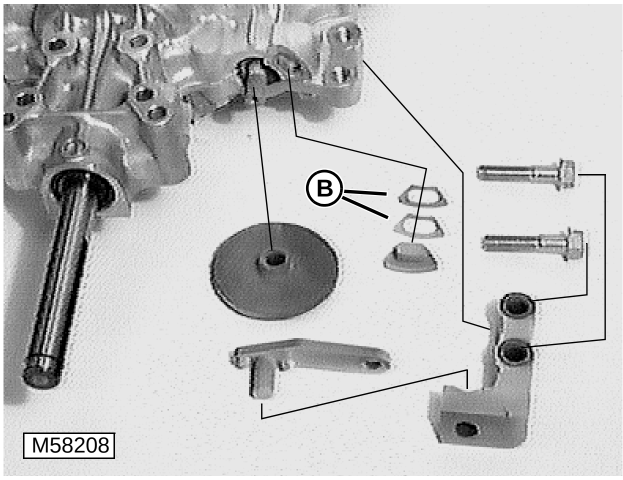


6. Install 17 cap screws (E) finger tight initially and then tighten from center-to-outside in a crossing pattern, beginning with two cap screws (G). Tighten 17 cap screws to specifications.
7. Install new o-ring on drain plug (F) and tighten it to specification.

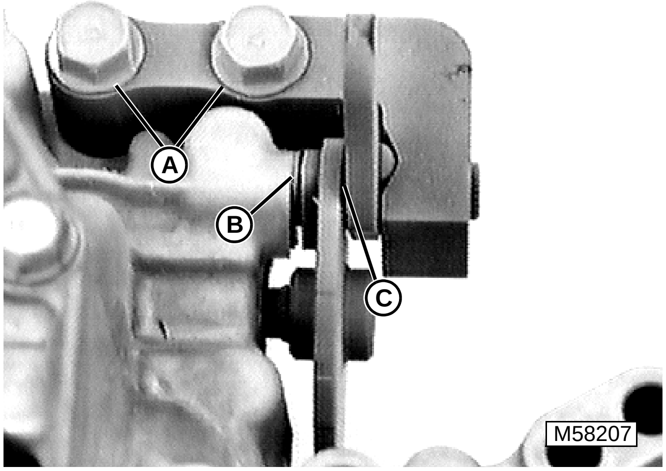
Specifications:

New upper case . . . . . 27—31 N•m (243—278 lb-in.)
Used upper case . . . . 23—27 N•m (200—243 lb-in.)
Drain plug . . . . 20—24 N•m (174—217 lb-in.)

BRAKE ASSEMBLY—INSTALLATION



Brake Pad Adjustment

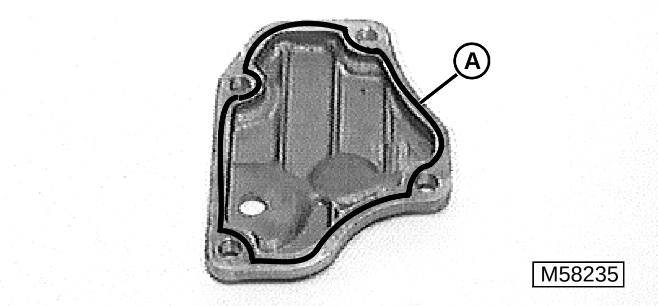


1. Install brake components to transaxle and, using friction puck shims (B), adjust air gap (C) between brake lever and brake disc (use feeler gauge) to specification.
2. Tighten cap screws (A) to specification.
3. Brakes should hold tractor on 17° slope and not drag when tractor is level and pushed in neutral.

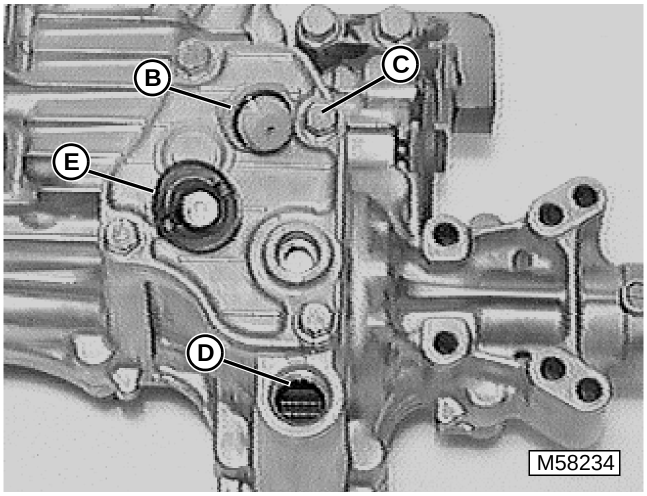
Specifications:

Brake air gap . . . . 0.254 mm (0.010 in.)
Brake cap screws. . . . 44—59 N•m (391—521 lb-in.)

RESERVOIR COVER AND BREATHER VALVE—ASSEMBLY



1. If reservoir cover was removed or replaced, apply a solid bead (A) of John Deere Form-In-Place Silicone Gasket Sealant around the cover, staying to inside of holes.



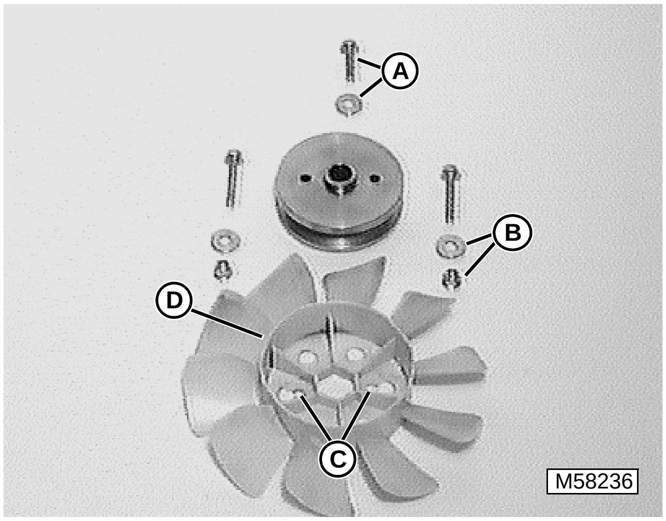
2. Install cover to reservoir and fasten with 4 cap screws (C). Tighten cap screws to specification.
3. Fill reservoir with 1.6 L (1.7 U.S. qt) of John Deere Plus-4, 10W30, Class-CD engine oil. Oil should reach bottom of fill hole (D).
4. Install breather valve assembly (E) and fill cap (B).

Specification:

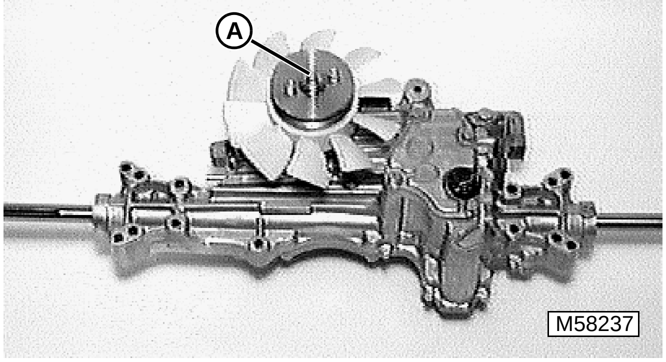
Reservoir cover cap screws

. . . . 20—24 N•m (174—217 lb-in.)

FAN AND DRIVE SHEAVE—INSTALLATION



1. Assemble fan to transaxle drive sheave using two fan holes (C). Two washers and nuts (B) go under fan. Bottom fan lip (D) goes towards transaxle.



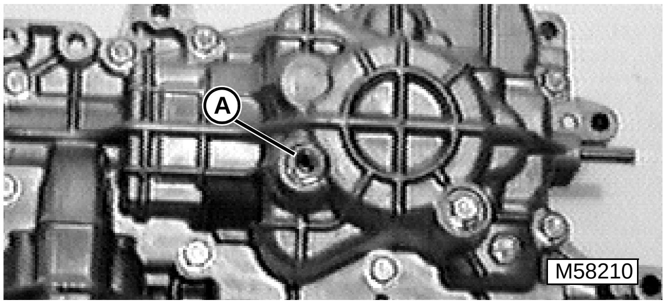
2. Install sheave/fan assembly to pump input shaft with cap screw and washer (A). Tighten cap screw to specification.

Specification:

Drive sheave cap screw

. . . . 13.5—20 N•m (120—168 lb-in.)

TRANSAXLE BLEED PROCEDURE



NOTE: This procedure is used before the transaxle is installed. If the transaxle is already installed see Standard Transaxle Bleed Procedure this page.

1. Turn transaxle over.
2. Remove recess plug (A) from bleed port stack.
3. While you pour new oil into hole, have a helper hold transaxle off bench and turn brake disc to rotate motor shaft and bleed internal pump, motor, and center block assembly.
4. Stop pouring oil when oil reaches bottom of hole. Apply John Deere Pipe Sealant with Teflon® or Teflon® tape to pipe plug. **DO NOT** allow any tape to enter internal portion of bleed port stack. Tighten plug to specification.

Specification:

Bleed port plug. . . . . 8 N•m (72 lb-in.)

Standard Transaxle Bleed Procedure

1. Safely raise and block rear wheels a minimum of 51 mm (2 in.) off the surface.
2. Run engine at slow idle.
3. Carefully engage and disengage transport (free-wheel) lever while helper pushes shift lever into forward, neutral, and reverse. Repeat several times.
4. When drive wheels start to turn, shift to neutral and be sure transport lever is disengaged.
5. Safely lower tractor to surface.
6. Sit in seat, shift into forward, and, if necessary, have helper push tractor until transaxle drives tractor under its own power.
7. Move throttle lever to fast idle and alternate shift lever between forward and reverse several times until transaxle is responsive and obtains full forward speed of 8 km/hr (5 mph) and reverse speed of 4.2 km/hr (2.6 mph).
8. Recheck and top-off oil level.

IMPORTANT: To test and adjust entire traction drive system see Tests and Adjustments earlier in this section.

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STEERING

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SPECIFICATIONS

TEST AND ADJUSTMENT SPECIFICATIONS

Steering Backlash	Minimum without binding

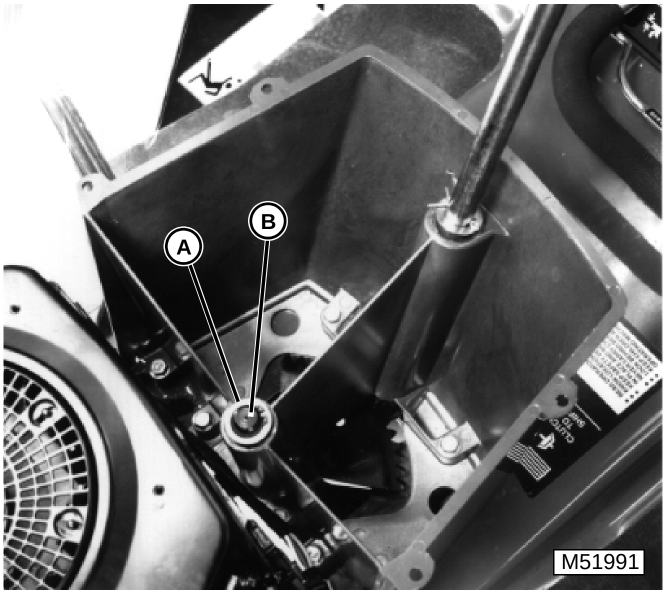
SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from your SERVICE-GARD Catalog.
Some tools may be available from a local supplier.

Inside Puller and Slide Hammer	Remove steering bushings

TESTS AND ADJUSTMENTS

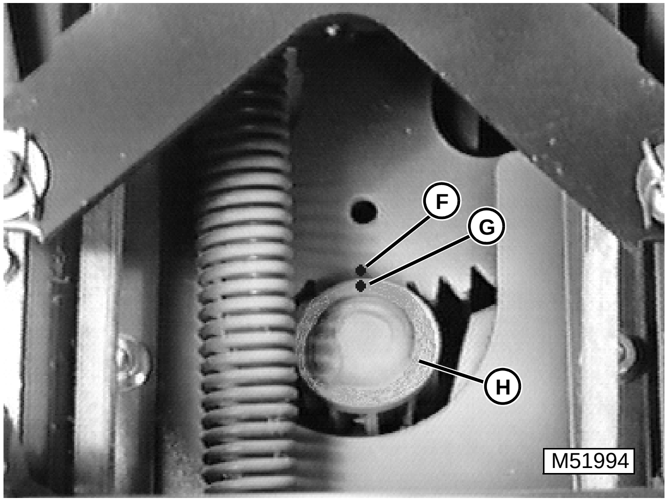
STEERING BACKLASH



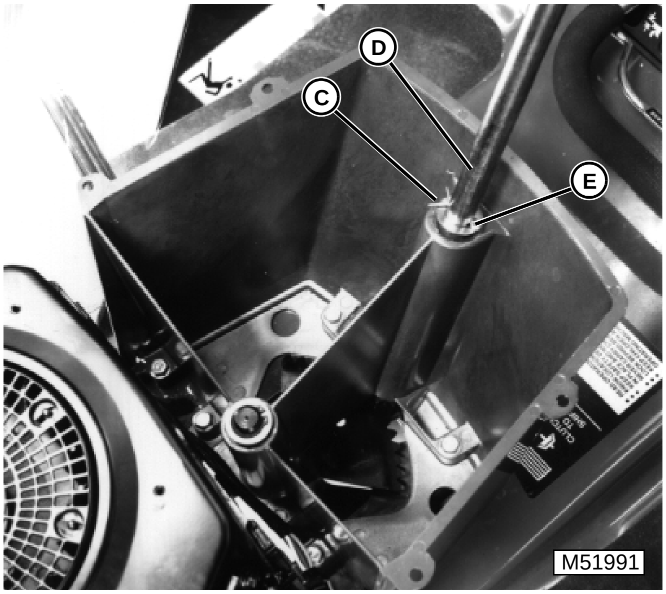
NOTE: *To adjust steering backlash, put four washers on bottom of sector shaft (B). Put enough washers on top to reduce play. Adjust quantity of washers top and bottom to minimize backlash without binding.*

IMPORTANT: Hard steering may be caused by front axle spindle grease fittings that are damaged or plugged.

1. Install shaft (B) with four bottom washers in pedestal.
2. Install washers and snap ring (A) on shaft (B).
3. Install pedestal on tractor.



4. Align mark (F) on sector gear and mark (G) on pinion gear (H) as steering pinion shaft (D) is installed from the bottom of the tractor

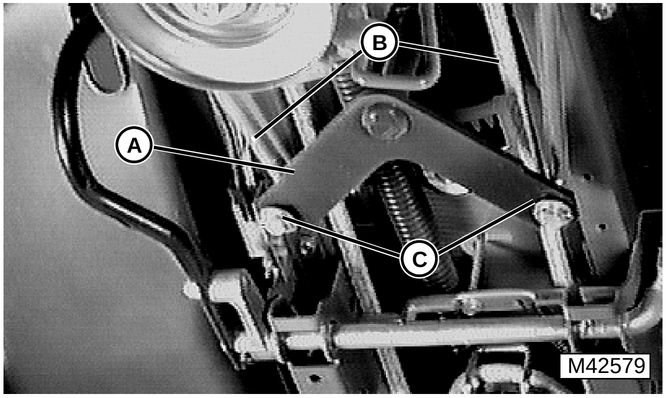


5. Install washers (E) and cotter pin (C).
6. Install and fasten tie rods.
7. Install steering wheel on top of steering shaft (D) and fasten with mounting hardware.
8. Turn steering left-to-right several times to test steering response and feel.
9. Repeat adjustment procedure until minimum backlash without binding is achieved.

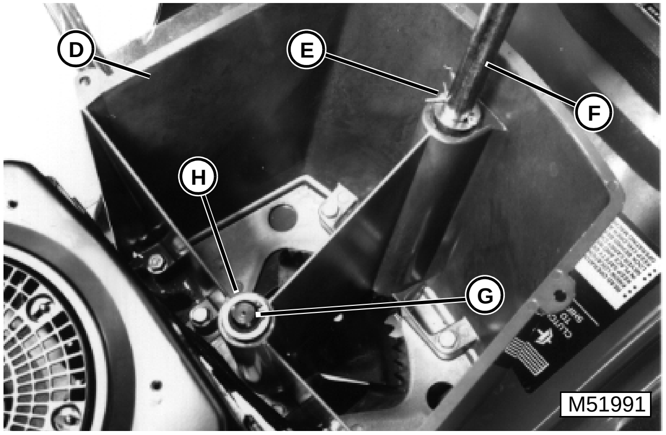
REPAIR

STEERING GEAR ASSEMBLY—REMOVAL

1. Remove battery and safely raise front of tractor.
2. Remove fuel tank and dash panel (see Remove and Install Fuel Tank and Dash Panel Assembly in Engine Section).

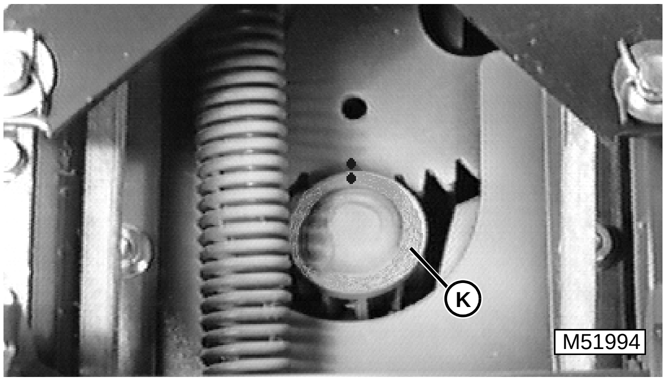


3. Remove cotter pins and washers (C).
4. Remove tie rods (B) from steering yoke (A).

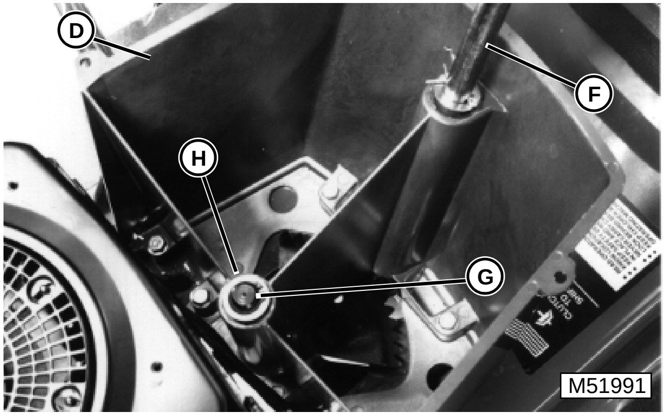


NOTE: *Write down location and number of washers on pinion and sector gear shafts. If a new shaft is installed, number and placement of washers may need adjustment.*

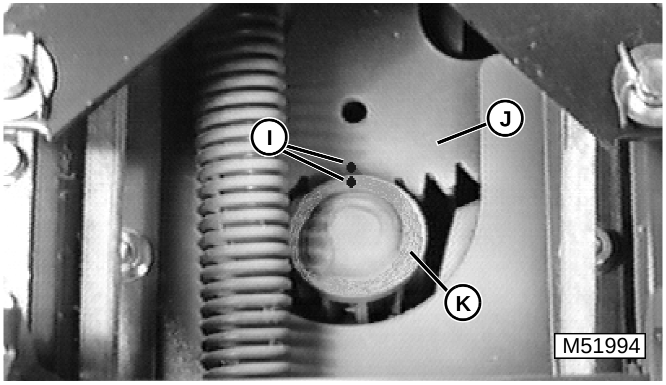
5. Remove cotter pin and washer(s) (E) from steering pinion shaft (F).
6. Remove pinion gear shaft from bottom of tractor.
7. Inspect shaft and pinion gear assembly, replace as necessary.



NOTE: *Steering pinion gear (K) can no longer be removed from the steering shaft. There may be 0—3 washers installed above gear (K). These washers are not interchangeable with other washers on the shaft. They are needed to ensure proper pinion gear (K) to sector gear (J) backlash engagement for proper steering response.*

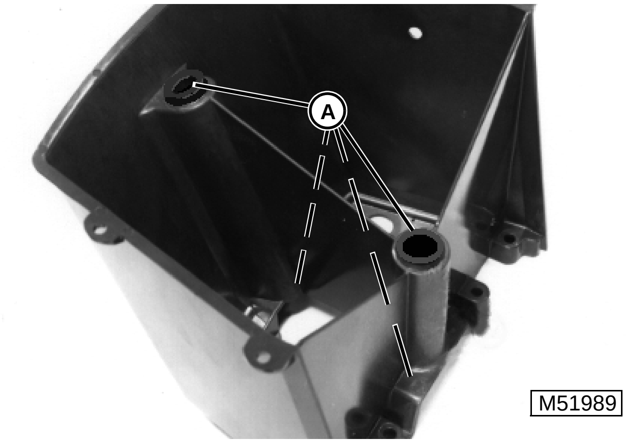


8. Remove pedestal (D) and sector gear shaft (G) as an assembly.
9. Remove snap ring and washer(s) (H).
10. Remove sector gear shaft (G).
11. Replace worn or damaged parts as necessary.
12. Adjust steering backlash (see Adjust Steering Backlash later in this section).



13. Install assembly in reverse order, making sure pinion gear (K) and sector gear (J) alignment marks (I) are aligned as steering pinion shaft (F) is installed.

PEDESTAL BUSHINGS—REPLACEMENT



1. Inspect four bushings (A) installed in steering sleeves of pedestal. If worn or damaged, replace them individually or as a set.
2. Clamp pedestal to stationary bench.
3. Use a slide hammer puller set up with inside jaws to remove four bushings.
4. Install new bushings using a rubber hammer.

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SPECIFICATIONS

SERVICE EQUIPMENT & TOOLS

NOTE: Order tools from your SERVICEGARD catalog.
Some tools may be available from a local supplier.

Inside Slide Hammer Puller . . . . Remove wheel bearings.

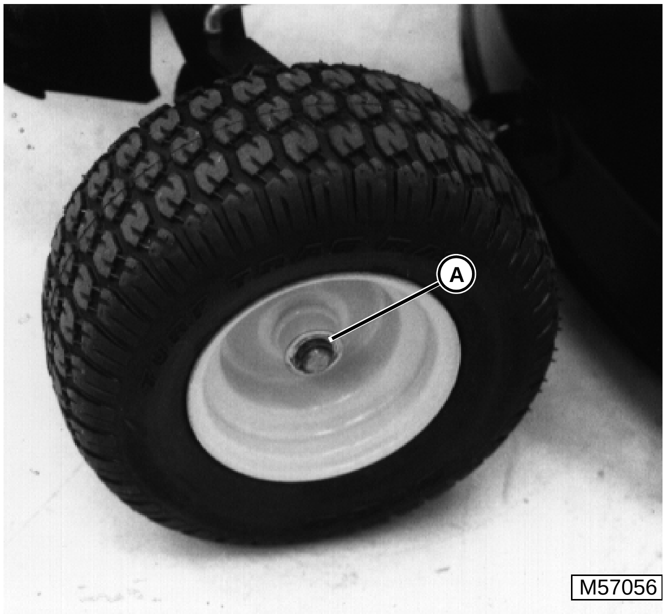
OTHER MATERIAL

Dubois' MPG-2® Multi-Purpose Grease . . . . Lubricate spindles

WHEELS

FRONT WHEELS—REMOVAL & INSTALLATION

1. Safely lift and support tractor.
2. Remove plastic cap.



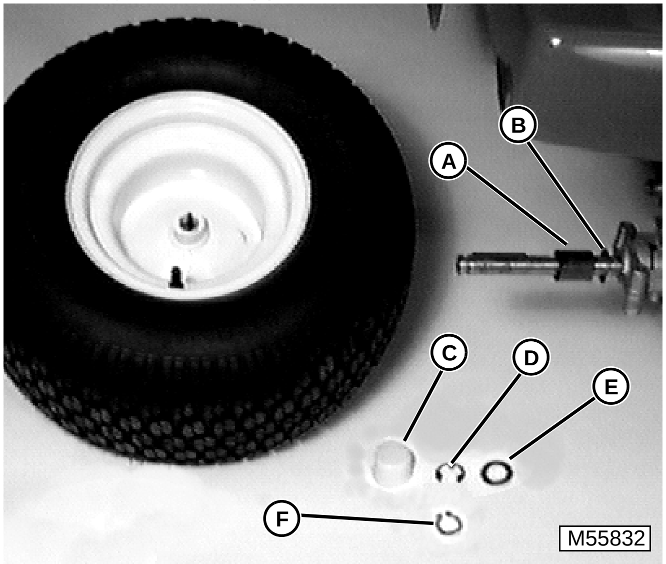
3. Remove snap ring (A) and wheel.

NOTE: *Front wheels are installed with valves to the inside.*

4. Grease spindles with specified grease.
5. Install wheel on axle (valve stem on inside).
6. Install snap ring (A).
7. Install plastic cap.

REAR WHEELS—REMOVAL & INSTALLATION

1. Safely lift and support tractor.



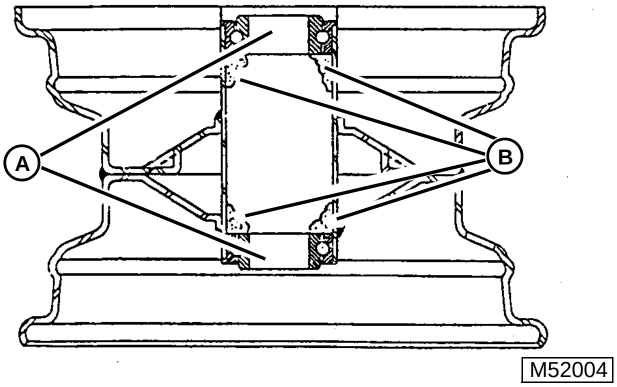
2. Remove plastic cap (C), E-ring (D) (gear) or snap ring (F) (hydro), and outer washer (E).
3. Remove wheel.

NOTE: *Rear wheels are installed with valves to the outside. Gear drive tractors have spacer (A) between the transaxle case and wheel, hydro tractors do not. Inner washer (B) is used on both transmissions. Left and right rear wheels are not interchangeable on the STX30 Lawn Tractor. The right rear wheel is identified by a short inside hub. They must be installed on the proper side.*

4. Install wheel on axle.
5. Install outer washer (E), E-ring (D) or snap ring (F), and plastic cap (C).

FRONT WHEEL BEARINGS—REPAIR

1. Remove bearings (A) using slide hammer puller.



2. Install new bearings using suitable driver on outside race of bearing.
3. Pack area behind bearing (B) with specified grease.

FRONT WHEELS— TOE-IN & CAMBER

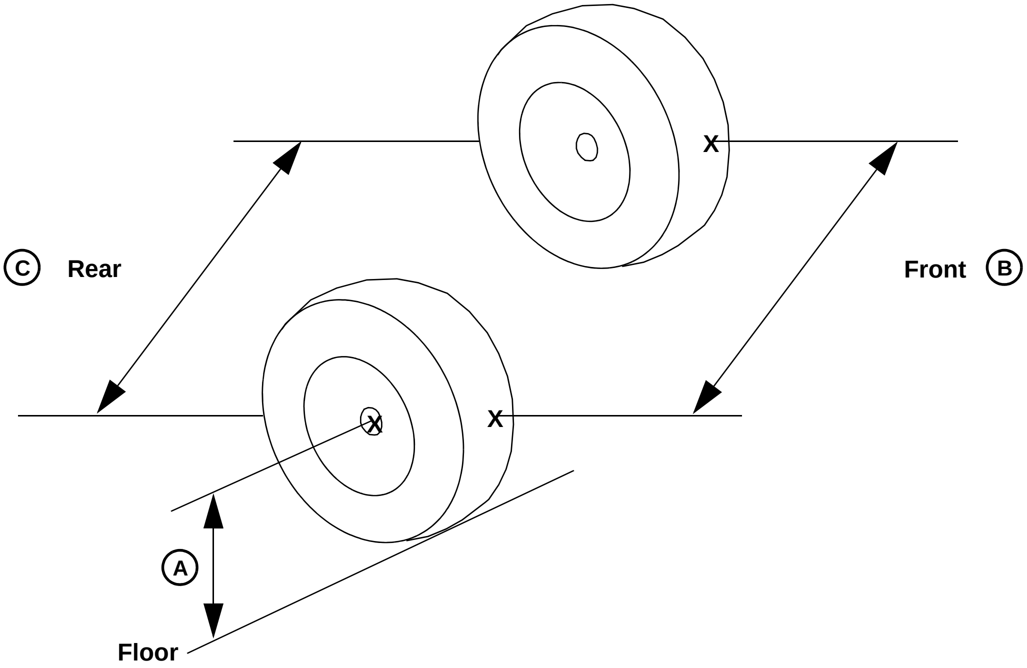
Reason:

To insure tractor toe-in is within specification.

Procedure:

Measure toe-in using the following procedure:

1. Equalize front tire pressure (12 psi).
2. Turn wheels so they are pointing straight ahead. If one wheel has more toe-in than the other, use steering wheel logo to determine straight ahead.



3. Measure distance (A) from the floor to the center of wheel hub.
4. Mark the front and rear of each tire at the same height as measured from the floor. Make a mark (X) on the center rib of each tire.
5. Push front of both tires outward, simultaneously.
6. Measure distance (B) between marks on front of tires.
7. Measure distance (C) between marks on rear of tires.
8. Subtract front measurement from rear measurement to determined toe-in value.

NOTE: *If toe-in is NOT within specification, order and install adjustable tie rod service kit. This kit will correct toe-in if one wheel has noticeably more toe-in than the other. Excessive toe-in of both wheels will require two kits.*

Procedure:

Measure camber using the following procedure:

1. Equalize front tire pressure (12 psi).
2. Turn front tires straight ahead.
3. Use a square to establish a vertical surface to measure from.
4. Measure distance from top edge of rim (not tire) to square.
5. Measure distance from bottom edge of tim (not tire) to square.
6. Subtract top measurement from bottom measurement to determine camber value.

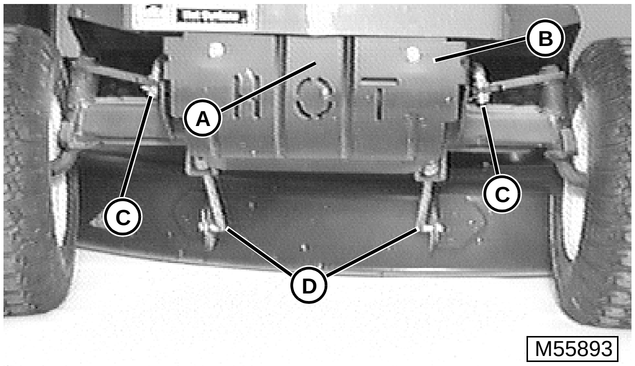
Specifications:

1989—1995 STX Model Year
Front Tire Size—13x6.5-6
Toe-in. . . . . . . .15 mm (0.59 in.) to 45 mm (1.8 in.)
Camber . . . . . .6 mm (0.24 in.) to 16 mm (0.63 in.)

1996 STX Model Year
Front Tire Size—15x6.5-6
Toe-in. . . . . . . .17 mm (0.67 in.) to 51 mm (2.0 in.)
Camber . . . . . .6 mm (0.24 in.) to 16 mm (0.63 in.)

FRONT AXLE REMOVAL & INSTALLATION

1. Safely support front of tractor.
2. Remove front wheels.
3. Disconnect draft arms (D) from axle.



4. Remove tie rods (C) at spindle arms.
5. Remove muffler shield(s) and muffler (B).
6. Remove pivot cap screw (A).
7. Remove axle and replace parts as necessary.
8. Grease and install axle. Tighten pivot cap screw to specification.
9. Install muffler to specification.
10. Install muffler shield(s).
11. Connect tie rods to axle (long leg in axle spindle).
12. Connect draft arms to axle.

Specifications:
Pivot Cap Screw . . . . 54 N•m (40 lb-ft)
Muffler-To-Engine Nuts . . . .
. . . . 19—30 N•m (168—265 lb-in.)
Tie Rod Nuts (STX30 & STX38 SN —210000) . . . . .
. . . . . 22 N•m (16 lb-ft).

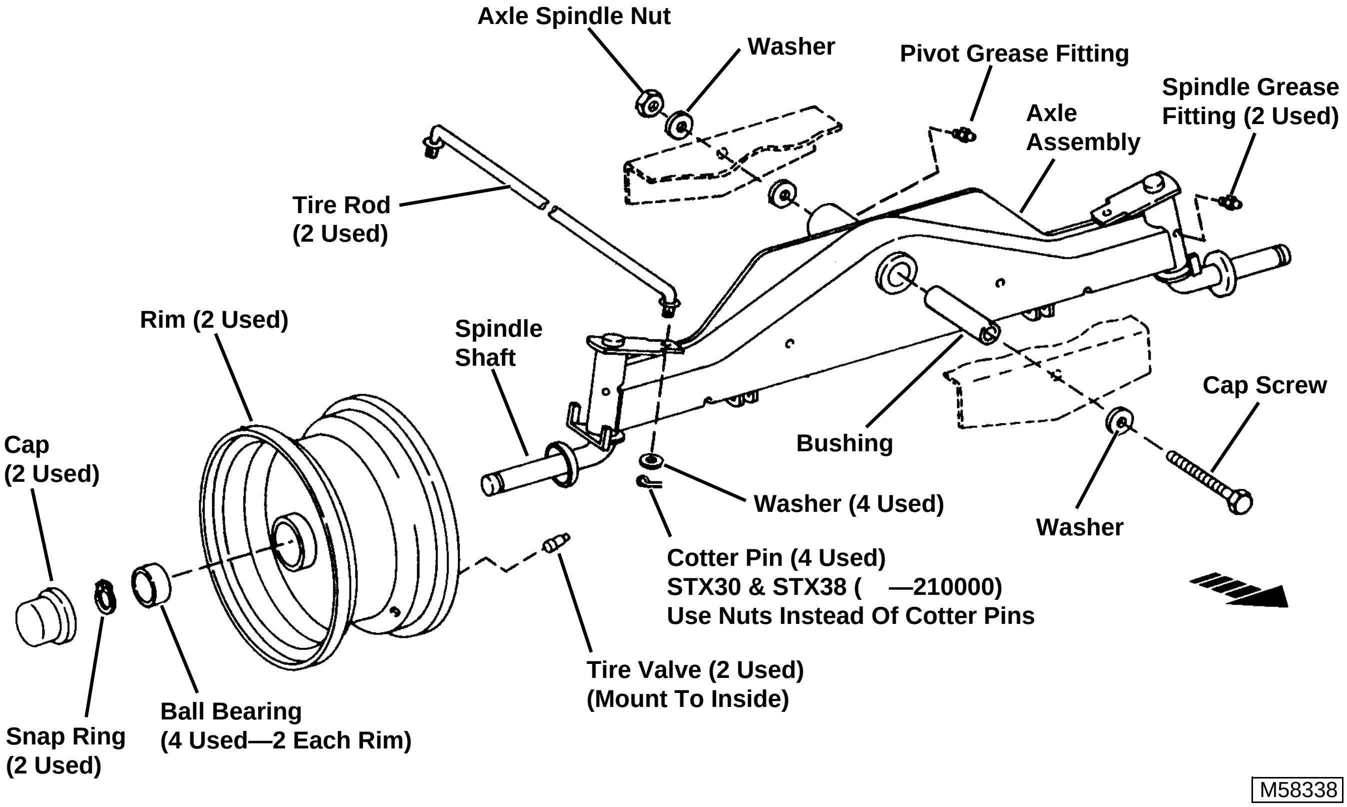
REPAIR

1. Remove axle.
2. Remove bushing (I), you may need to use a driver and hammer or an hydraulic press.

NOTE: If new axle is being installed, original bushing can be used if in good condition. If front axle pivot grease fittings are damaged or plugged, pivot could seize up due to lack of lubrication.

3. Grease axle pivot ID and bushing OD and install. Tighten axle spindle nut to specification.
4. Grease (use Du Bois' MPG-2®) spindle shafts before installing rims.

Specifications:
Axle Spindle Nut. . . . . 54 N•m (40 lb-ft)


Axle Spindle Nut
Washer
Pivot Grease Fitting
Axle Assembly
Spindle Grease Fitting (2 Used)
Tire Rod (2 Used)
Rim (2 Used)
Spindle Shaft
Cap Screw
Bushing
Cap (2 Used)
Washer (4 Used)
Washer
Cotter Pin (4 Used) STX30 & STX38 (—210000) Use Nuts Instead Of Cotter Pins
Tire Valve (2 Used) (Mount To Inside)
Ball Bearing (4 Used—2 Each Rim)
Snap Ring (2 Used)
M58338

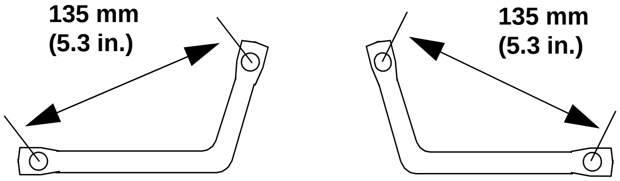
MOWER DECKS

DIAGNOSIS

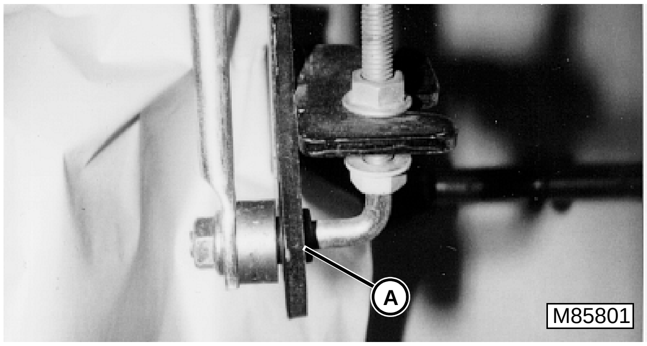
IMPORTANT: During hot weather the mower deck may become covered with a soot like material that looks like engine exhaust or belt dust. This black soot like material is a type of lawn mold. Do not change belts. There is no problem with the tractor or mower deck.

Test/Check Point	Normal	If Not Normal
1. Rear draft arm brackets. STX38—Only	Mower deck does not fall off lift system.	Modify and install rear draft arm brackets (M116688 and M116689) from current black deck STX Lawn Tractor. See page 8-7 this section.
2. Mower spindle.	Mower spindle welds not broken. Flanges not bent.	Poor cut quality. Blades cannot be leveled, bent spindle mounting flange. Blades contact deck. See spindle replacement on page 8-9 this section.
3. Mower deck.	Grass blows out side. Belt frays on jumps off idler.	If grass blows out front of deck see mower deck adjustment—page 8-9 this section. Install new idler kit—if applicable.

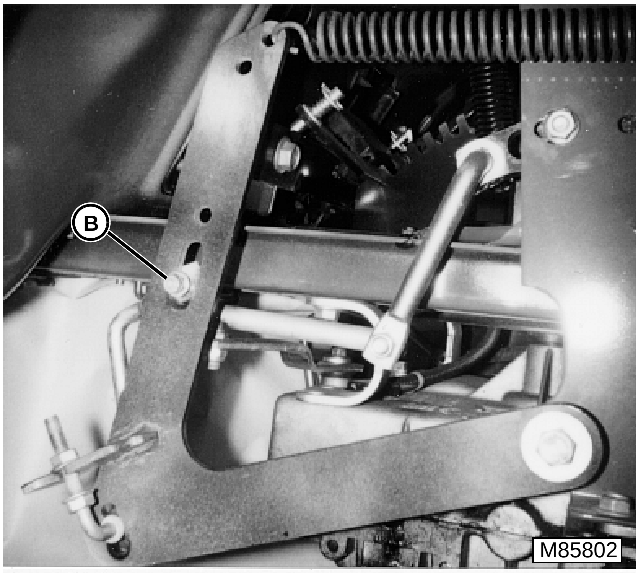
LIFT SYSTEM STX38 (M00STXB595001—750000) STX38 (M00STXB010001—139615)



1. Reshape LH and RH brackets to 135 mm (5.3 in.) hole centers.
2. Park tractor on level surface. Engage park brake.
3. Raise rear of tractor onto jack stands. Remove rear wheels.
4. Remove nut and old bracket from roller assemblies on both sides of tractor.



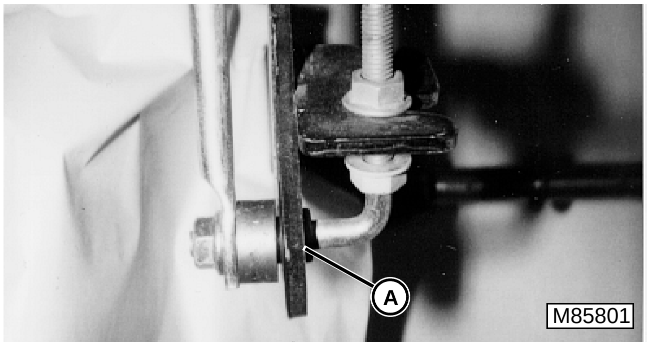
5. Install RH Bracket (M11688) on **left** side of tractor. Fasten lower end of bracket (A) with nut removed in Step 4.



6. Fasten upper end of bracket (B) to slot in lift arm with M6x20 cap screw and locknut. Tighten locknut to contact, then loosen 1 turn.

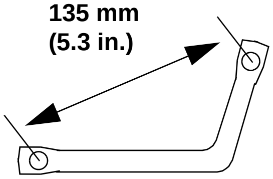
NOTE: Bracket must be free to move up or down in slot when roller is moved during side-to-side mower deck leveling adjustment.

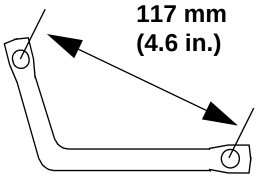
M



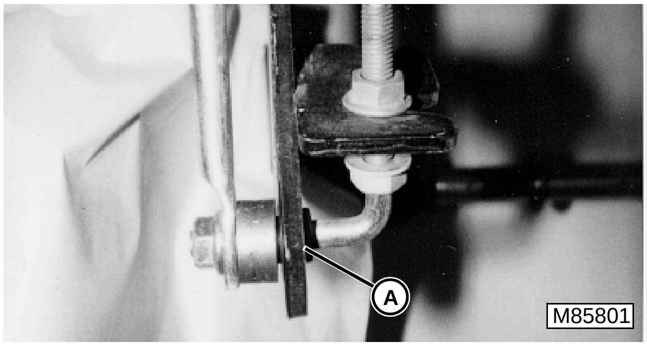
7. Install LH Bracket (M116689) on the **right** side of tractor. Fasten lower end of bracket (A) with nut removed in Step 4.
8. Fasten upper end of bracket (B) to slot in lift arm with M6x20 cap screw and lock nut. Tighten lock nut.
9. Replace rear tires and lower machine safely to ground.

STX38 (M00STXB139616—210000)

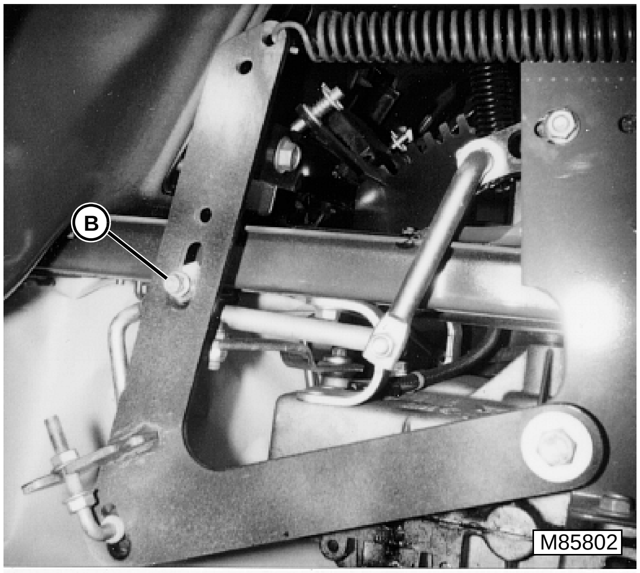




1. Reshape RH bracket (M116688) to 135 mm (5.3 in.) hole centers.
2. Reshape LH bracket (M116689) to 117 mm (4.6 in.) hole centers.
3. Park tractor on level surface. Engage park brake.
4. Raise rear of tractor onto jack stands. Remove rear wheels.
5. Remove nut and old bracket from roller assemblies on both sides of tractor.

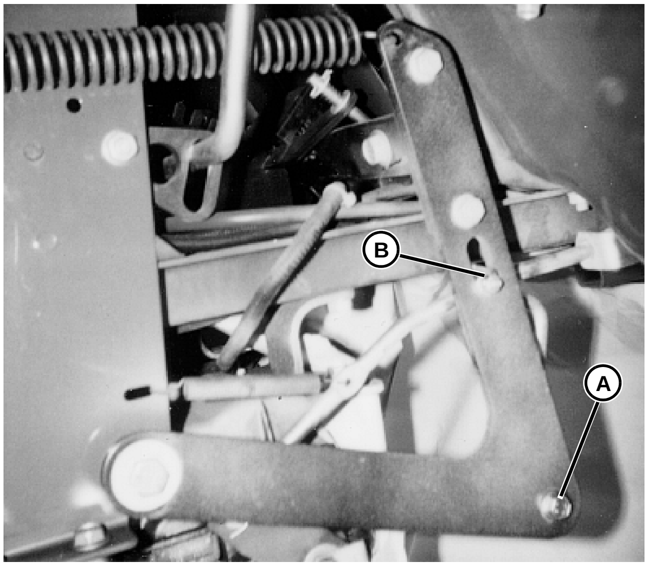


6. Install RH Bracket (M11688) on **left** side of tractor. Fasten lower end of bracket (A) with nut removed in Step 5.



7. Fasten upper end of bracket (B) to slot in lift arm with M6x20 cap screw and locknut. Tighten locknut to contact, then loosen 1 turn.

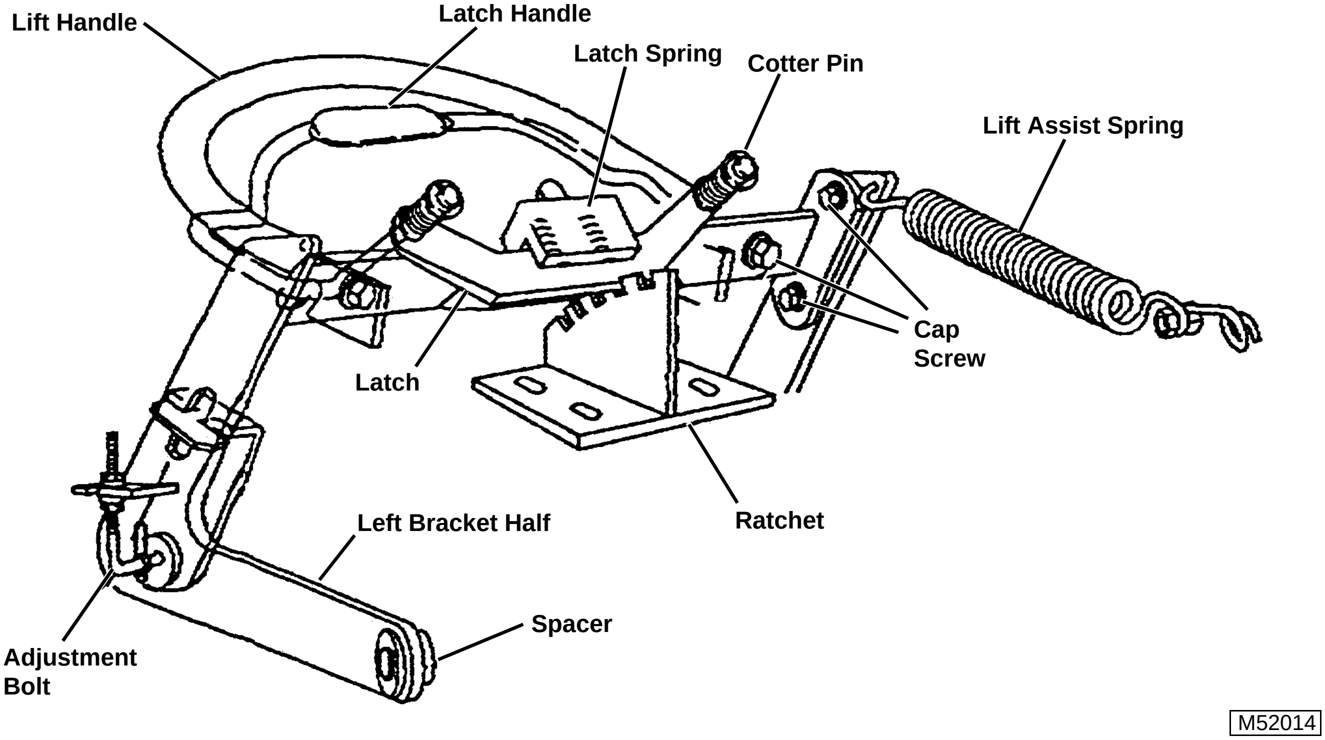
NOTE: Bracket must be free to move up or down in slot when roller is moved during side-to-side mower deck leveling adjustment.



M85803

8. Drill 1/4 in. hole in right side lift arm, 4.6 in. (117 mm) above hole for existing roller assembly.
9. Install LH Bracket (M116689) on the **right** side of tractor. Fasten lower end of bracket (A) with nut removed in Step 4.
10. Fasten upper end of bracket (B) to slot in lift arm with M6x20 cap screw and lock nut. Tighten lock nut.
11. Replace rear tires and lower machine safely to ground.

LIFT LINKAGE REPAIR— STX30 & STX38 (SN —210000)



NOTE: The STX38 uses a heavier assist spring, connected to a carriage bolt in a more rearward position than on the STX30.

Disassemble

1. Remove battery and mower.
2. Remove cap screws. Remove handle.
3. Remove cotter pins, washers, and springs.
4. Remove handle from latch.
5. Remove cap screws.
6. Remove cap screws and spacers from bracket halves.
7. Remove left and right bracket halves from tractor.
8. Remove latch and springs from bracket half.
9. Remove bolt, roller, and spacer.
10. Inspect and repair or replace parts.

Assemble

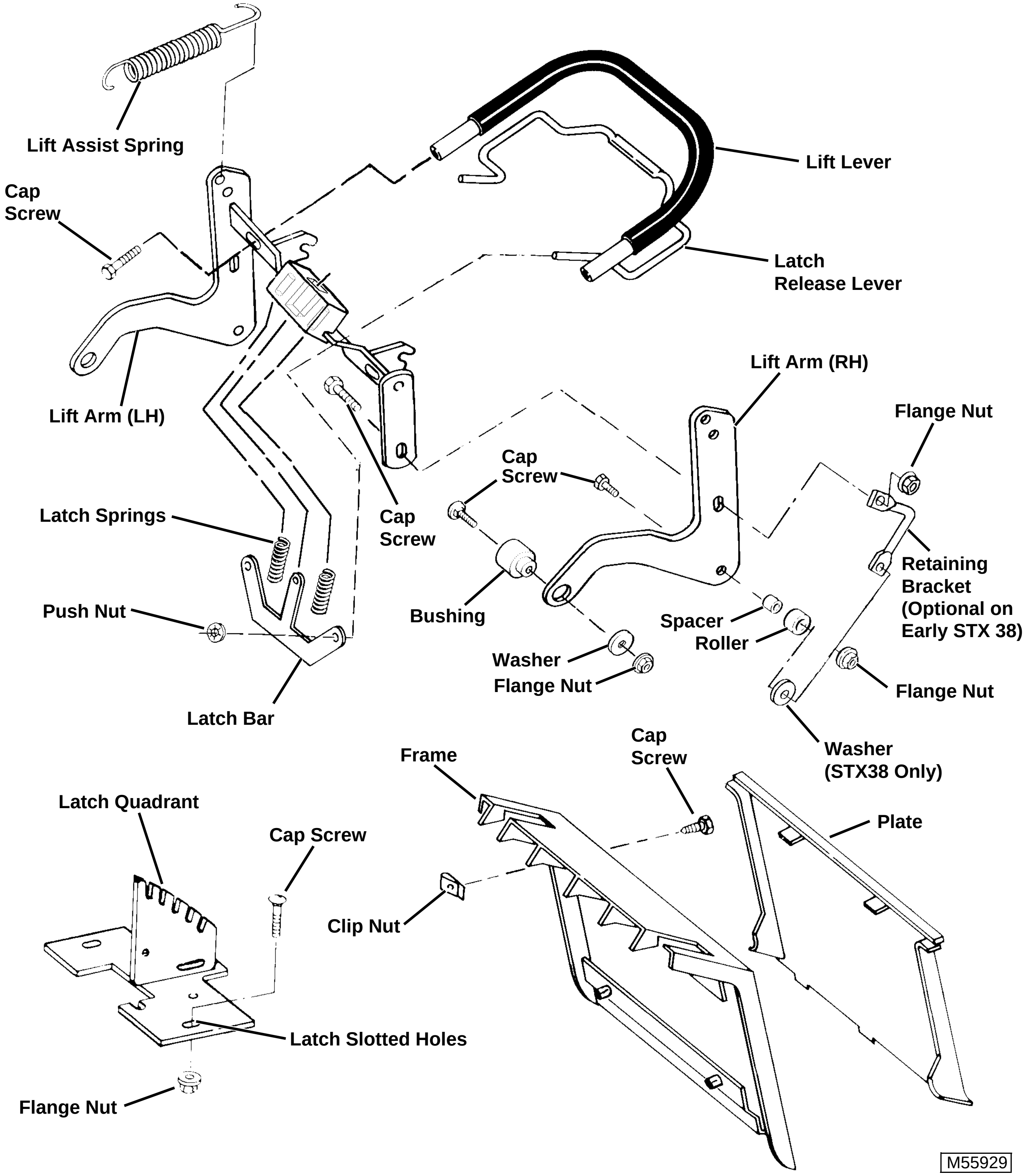
1. Install bolt, roller, and spacer.
2. Install latch and springs from bracket half.
3. Install left and right bracket halves from tractor.
4. Install cap screws and spacers from bracket halves.
5. Install cap screws.
6. Install handle in latch.
7. Install washers, springs, and cotter pins.
8. Install handle using cap screws.

NOTE: Adjust ratchet using slotted holes, for smooth engagement with latch.

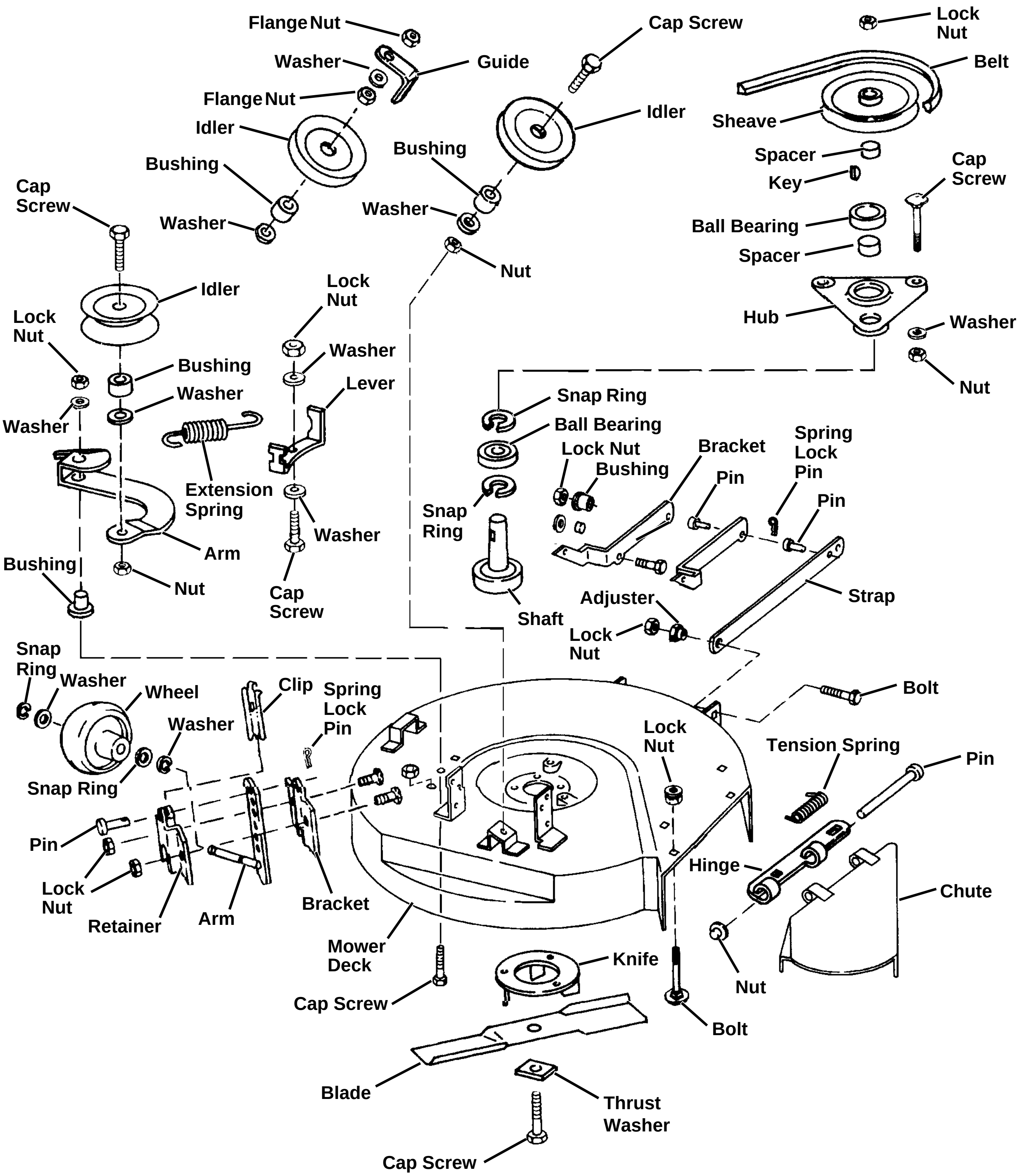
9. Install and adjust mower.
10. Install battery.

STX38 (SN 210001—) & STX46 (SN 240001—)

1. Remove battery and mower.
2. Check for worn or damaged components.
3. Adjust latch quadrant using slotted holes, if necessary, for smooth engagement with latch.
4. Install and adjust mower.
5. Install battery.



30-INCH MOWER DECK



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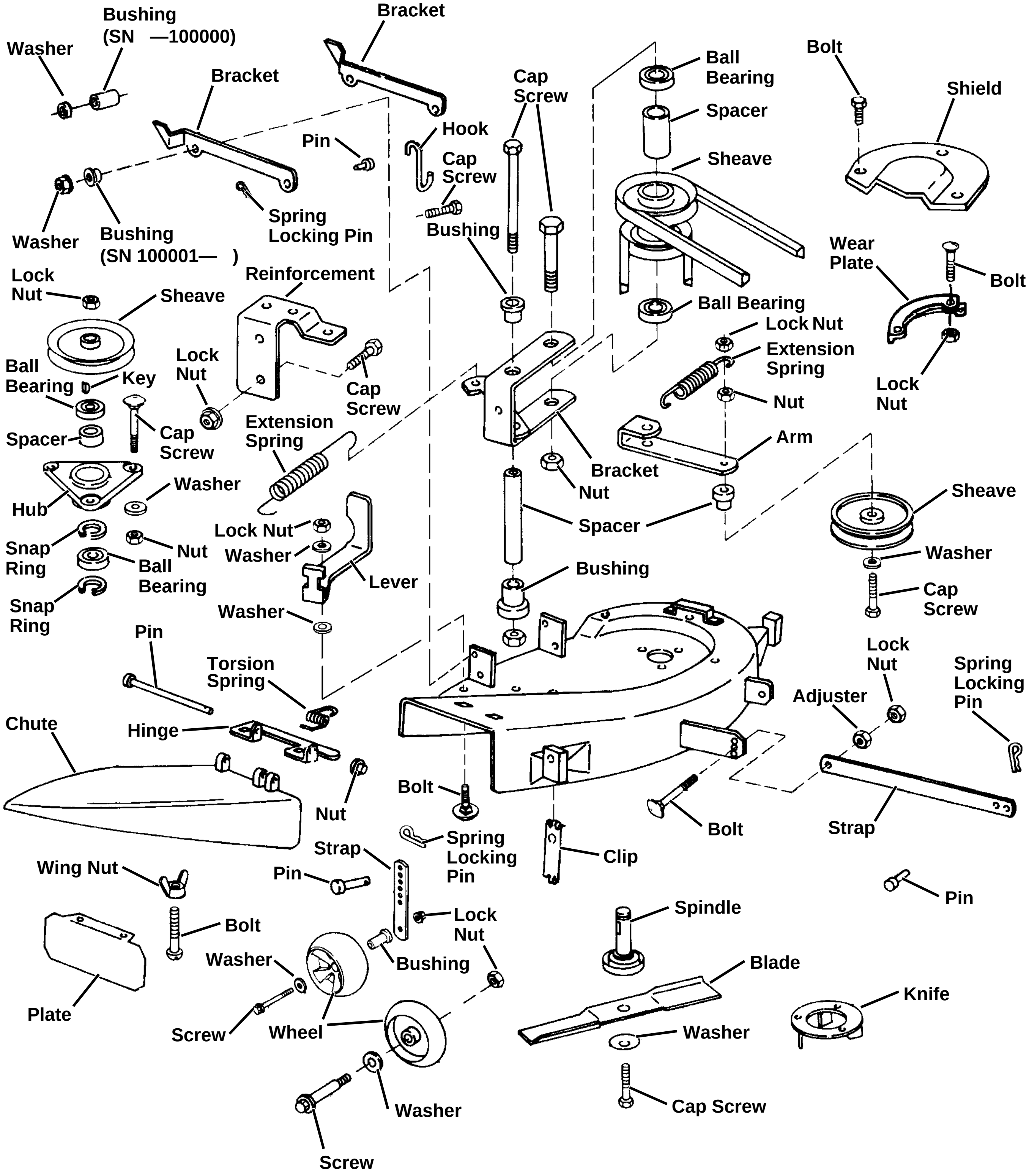
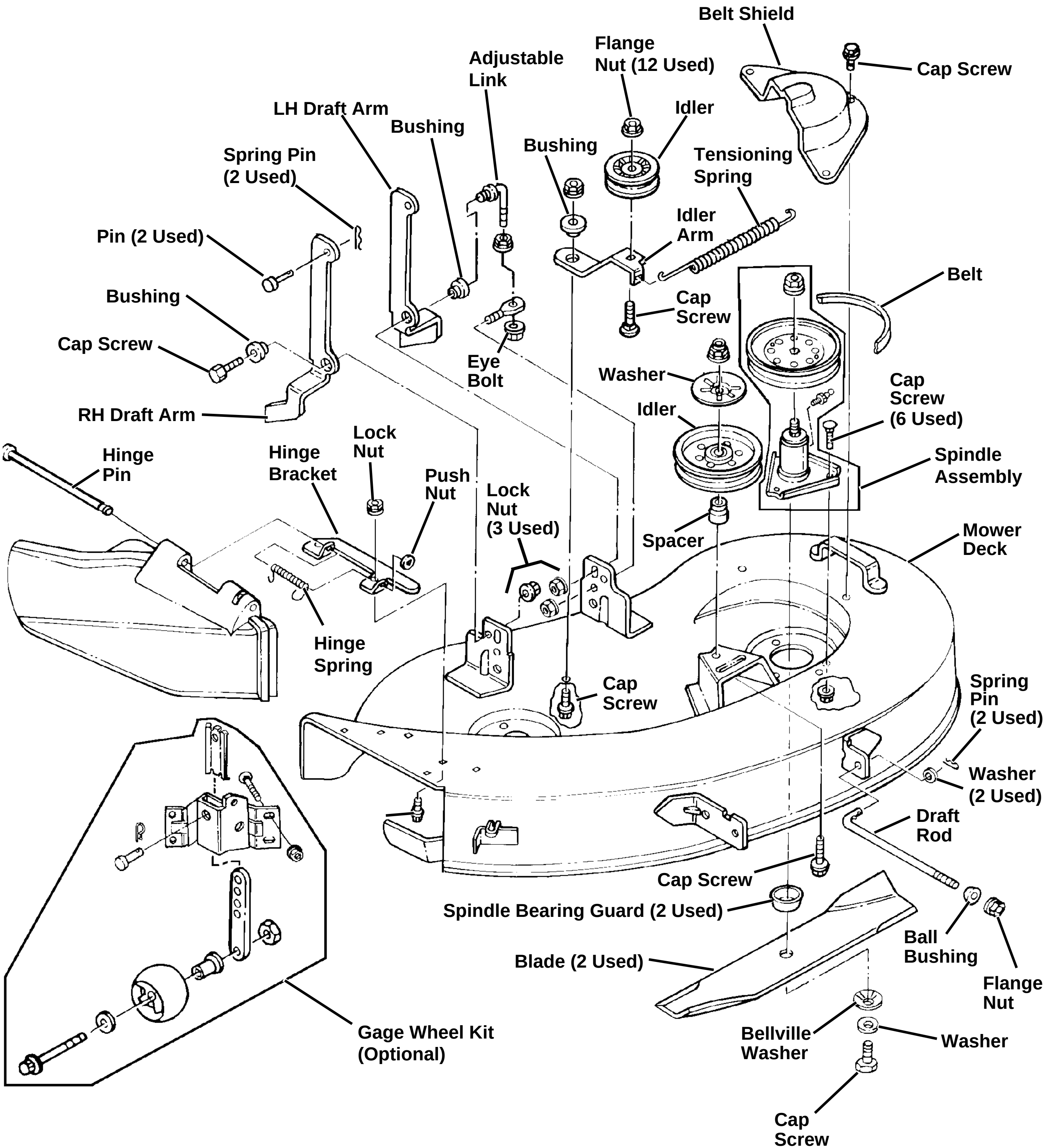
38-INCH MOWER DECK (SN —210000)



38-INCH MOWER DECK (SN 210001—270000)



Important: The STX38 power flow belt goes on the BOTTOM of the double sheave. Pull idler pulley to the right to release tension.

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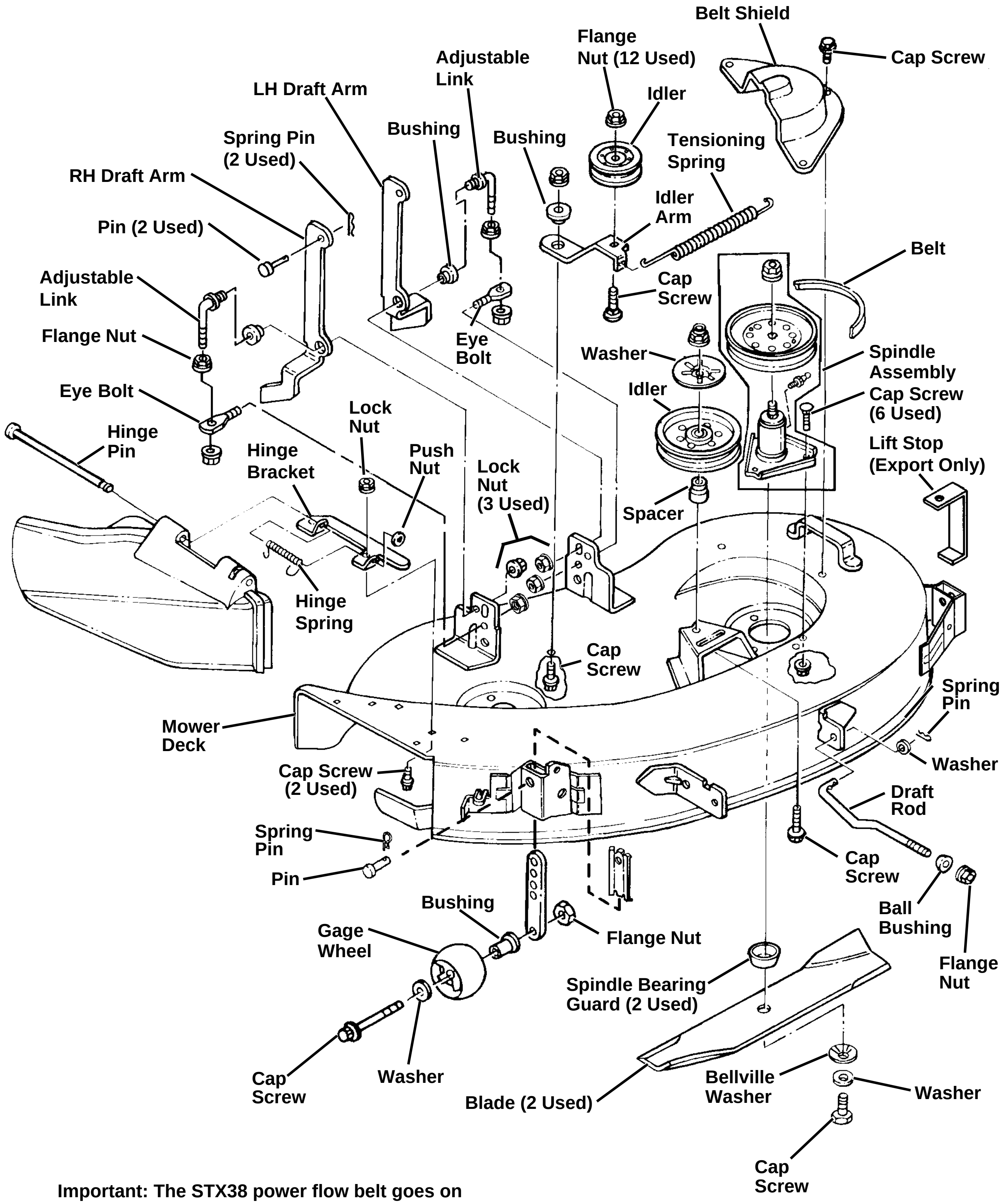
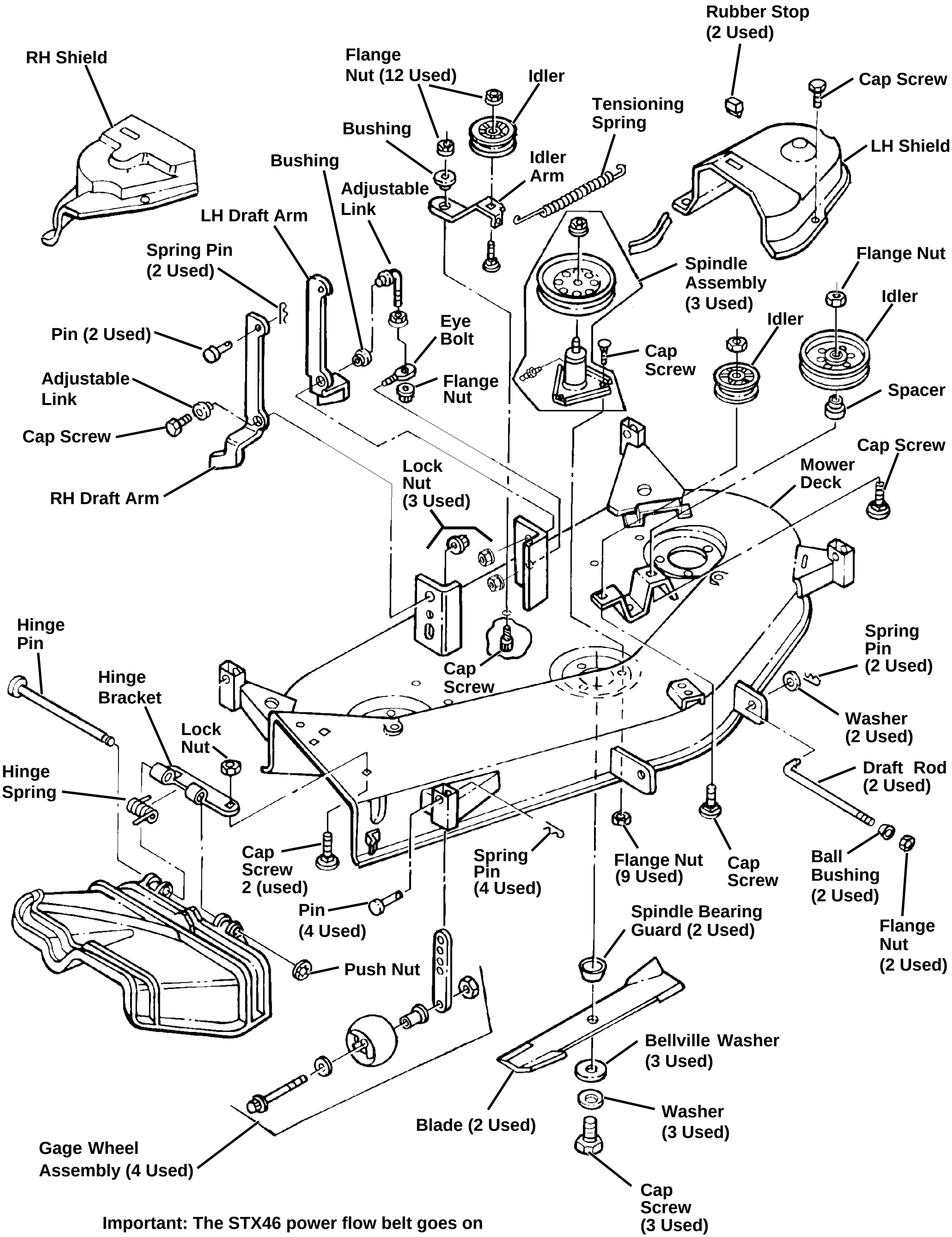
M

38-INCH MOWER DECK (SN 270001—595000)



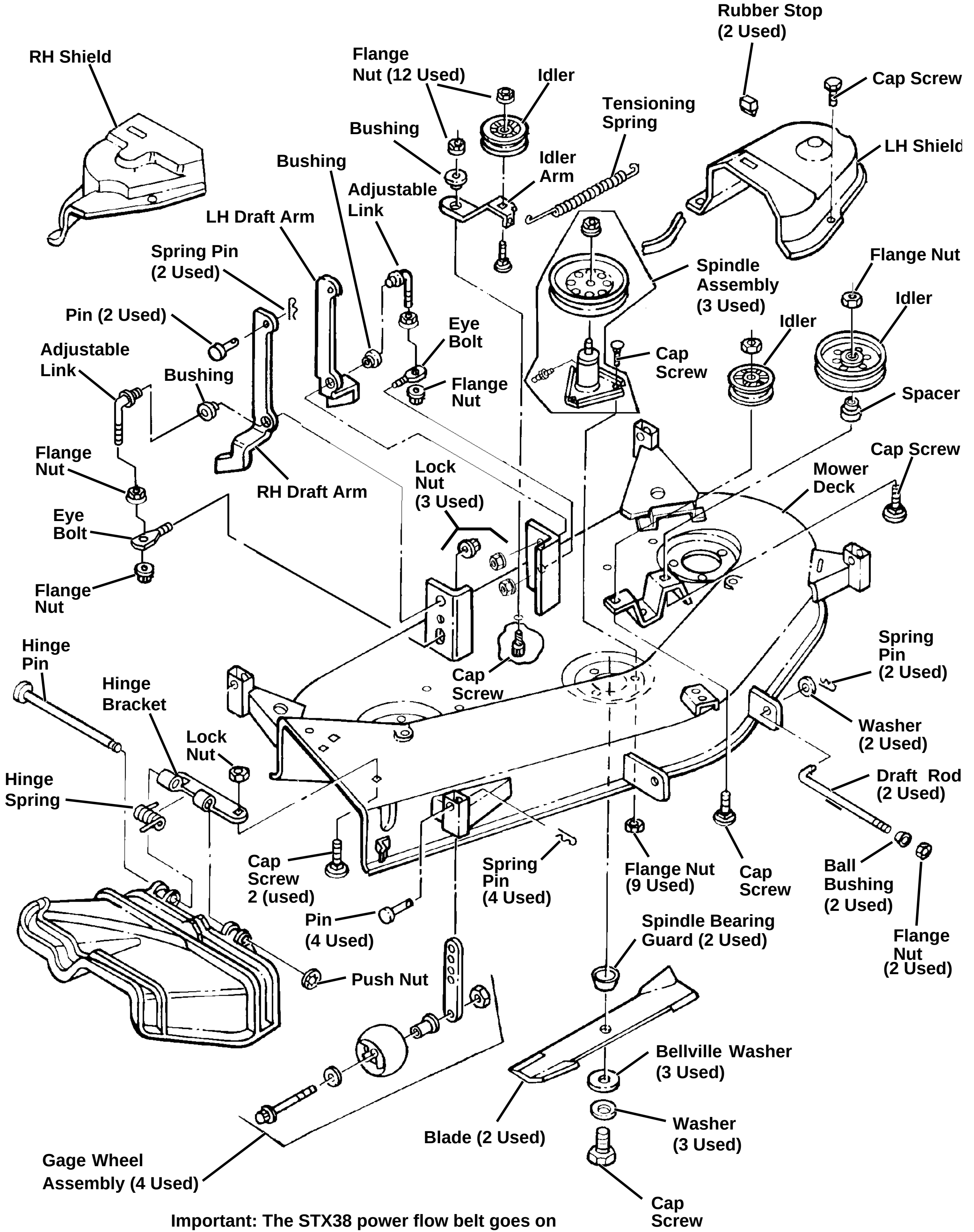
Important: The STX38 power flow belt goes on the BOTTOM of the double sheave. Pull idler pulley to the right to release tension.

46-INCH MOWER DECK (SN 240001—270000)



Important: The STX46 power flow belt goes on the TOP of the double sheave. Pull idler pulley to the right to release tension.

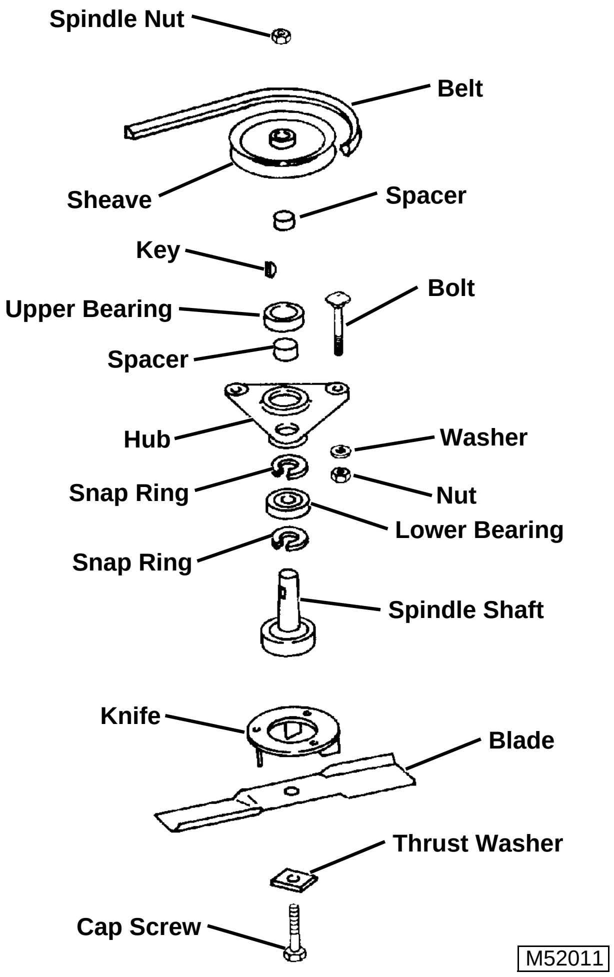
46-INCH MOWER DECK (SN 270001—595000)



Important: The STX38 power flow belt goes on the BOTTOM of the double sheave. Pull idler pulley to the right to release tension.

M58398

SPINDLES—
STX30 &
STX38 (SN —210000)



NOTE: STX30 spindle is shown, STX38 is similar. Late model spindles (SN 210000—) are not serviceable, they must be replaced as a complete assembly if any parts are bad.

⚠ CAUTION

Blades are sharp and could cause personal injury. Wear gloves or wrap blades with shop cloths to remove and install blades. DO NOT hold blade with bare hand. Use a block of wood wedged between deck and blade to keep spindle from turning.

Repair

1. Remove belt, nut, bolts, sheave and blade to remove spindle.
2. Press shaft down through hub.
3. Remove snap ring.
4. Press on inner and outer races of bearing to remove bearing and spacer.
5. Invert hub and press out bearing.
6. Inspect and replace parts as necessary.
7. Press bearing into hub until it contacts snap ring.
8. Insert spacer in hub. Fill area around spacer half full with John Deere Multipurpose Grease or equivalent.
9. Support bearing and press bearing against spacer.
10. Install snap ring and grease outside of bearing.
11. Support inner race of bearing and press shaft into hub.
12. Check rolling torque of spindle. Maximum allowable torque is 0.07 N•m (0.6 lb-in.)

Specifications

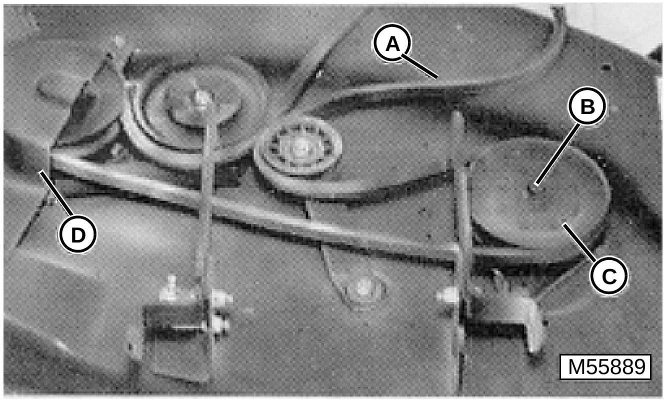
Hub to Mower Deck Bolt . . . . 25 N•m (19 lb-ft)
Sheave Nut . . . . 125 N•m (93 lb-ft)

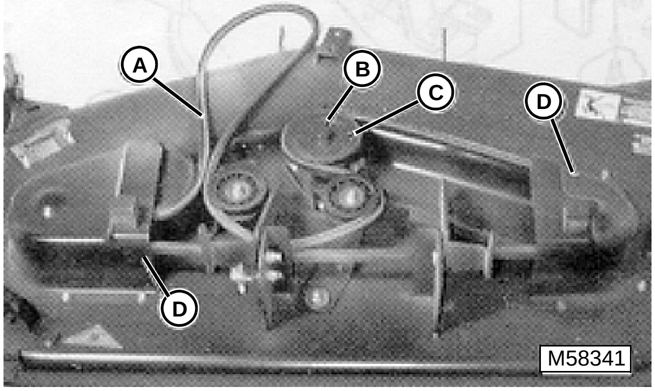
STX38 (SN 210001—) &
STX46 (SN 240001—)

IMPORTANT: The most common cause of bent or broken spindles is due to the blade hitting the ground, tree roots, stumps, other objects, or mower deck dropping off left system in rough terrain/conditions.
STX38 (M00STXC210001—271586)
STX38 (M00STXD210001—270000)
STX38 (M00STXE210001—271742)
STX38 (M00STXH270001—277924)
STX38 (M00STXJ270001—275551)
STX46 (M00STXF240001—270000)
STX46 (M00STXG240001—270000)
STX46 (M00STXK270001—270317)
STX46 (M00STXL270001—270356)
The following is a list of optional equipment available for these conditions:
STX38—Mower Deck Retaining Brackets
STX38—Gauge Wheel Kit
New spindles have a larger weld and increased flange material thickness. New spindles are used in production beginning with the following Product Identification Numbers:
STX38 (M00STXE271743—)
STX38 (M00STXH277925—)
STX38 (M00STXJ275552—)

STX46 (M00STXK270318—)
STX46 (M00STXL270357—)

NOTE: Spindles are not serviceable, they must be replaced as a complete assembly if any parts are bad.

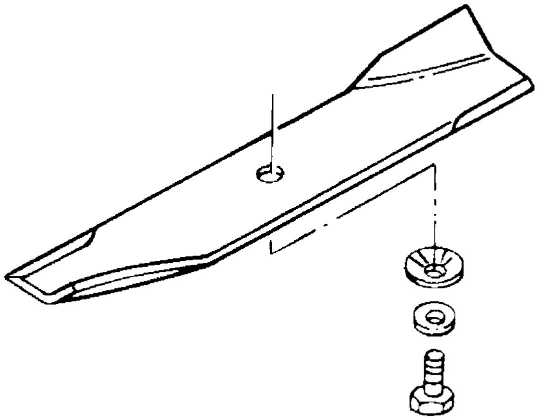




1. Remove shield(s) (D) and belt (A). DO NOT remove nuts (B) or sheaves (C) from spindles.

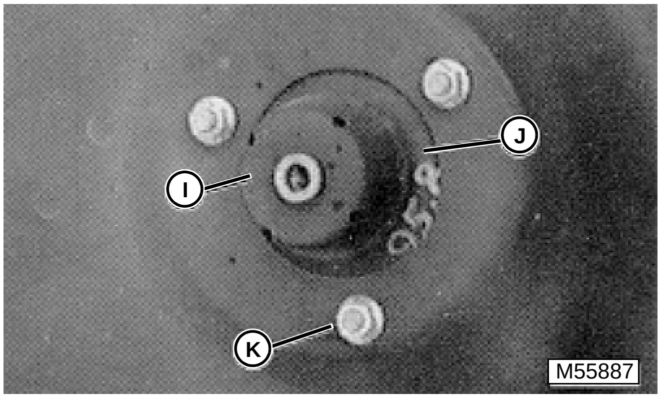
⚠ CAUTION

Blades are sharp and could cause personal injury. Wear gloves or wrap blades with shop cloths to remove and install blades. DO NOT hold blade with bare hand. Use a block of wood wedged between deck and blade to keep spindle from turning.



M58340

2. Remove cap screw (H), small washer (G), bellville washer (F) to remove blade(s) (E).

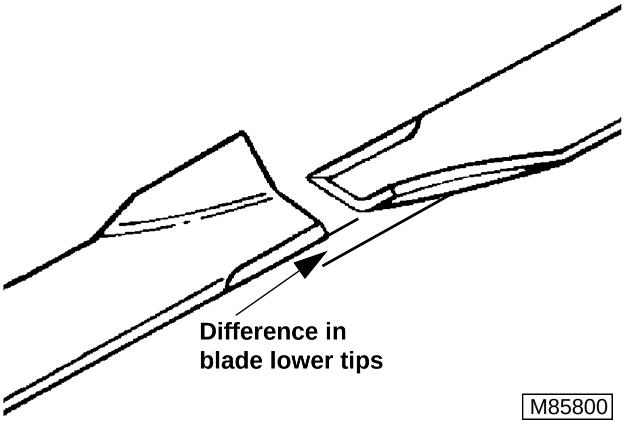


3. Remove spindle bearing guard(s) (I) and mounting hardware (K) to remove any spindle assembly (J). Inspect spindle assemblies for broken welds or bent flanges. Replace parts as necessary.
4. Install each spindle assembly in reverse order. Tighten mounting hardware to specification.
5. Install spindle bearing guard(s) and blade(s) to specification.
6. Install belt (A) and shield(s) (D), as shown.

IMPORTANT: DO NOT add grease to spindle grease fitting. They are for manufacturers use only. Adding grease may damage spindle seals.

Specifications:

Spindle Assembly Nuts
. . . . 23—30 N•m (200—265 lb-in.)
Blade Cap Screw . . . . . . .46—60 N•m (34—44 lb-ft).



7. With new spindles and blades installed, check blade alignment by measuring the difference in height, from one lower tip to the other tip.

Specifications:

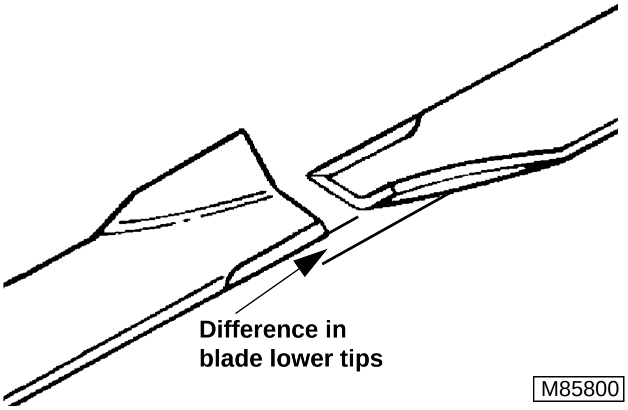
Blade difference . . . . 6 mm (1/4 in.)

MOWER BLADE ADJUSTMENT

Reason:

To insure mower deck blades cut evenly.

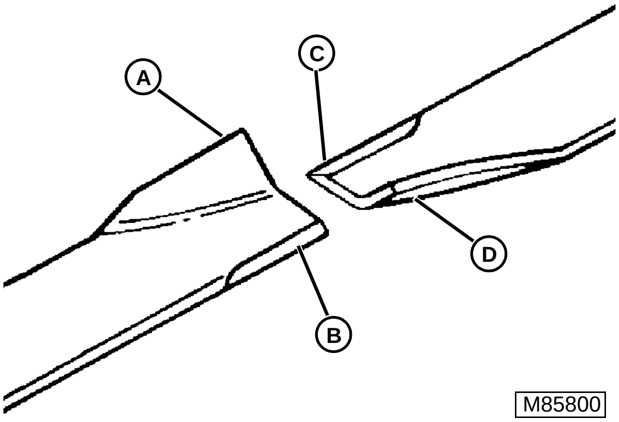
Procedure:



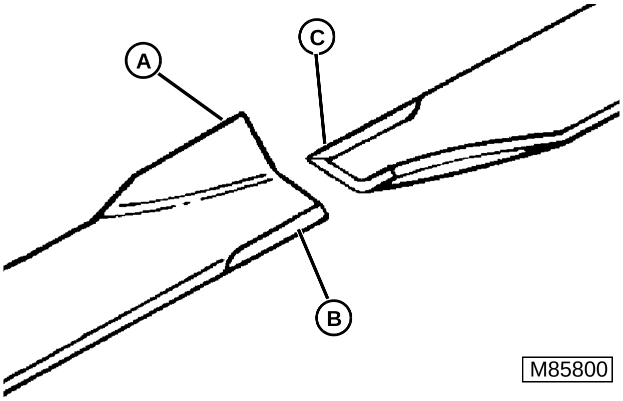
1. Check blade alignment by measuring the difference in height, from one lower tip to the other tip.

NOTE: Some mismatch between blades is normal. As a general rule if the difference between lower tip of one blade is less than 1/4 inch (6 mm) different than the lower tip of the other blade, it will be undetectable. No action is necessary. The comparison must be made with the tips rotated and positioned next to each other. The lower tip of each blade does the cutting, so compare the lower tips only.

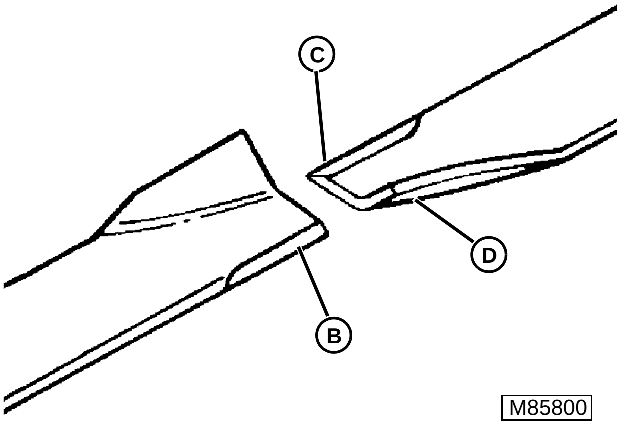
If blade difference is 1/4 inch (6 mm) or more, use the following procedure to determine cause.



1. Mark the blade tips that are being compared A—B and C—B.



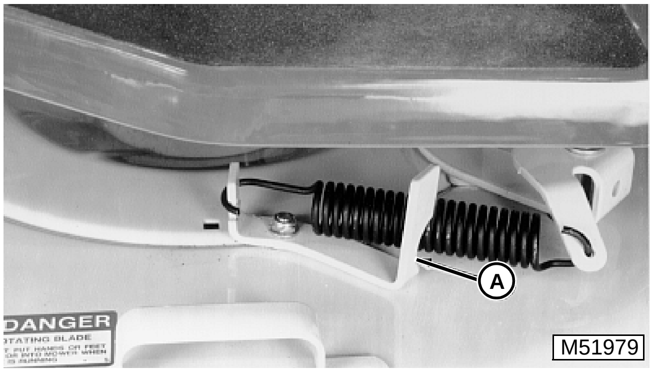
2. Compare tips A and B of first blade to tip C of the other blade.
3. If the difference between A and B is greater than 1/8 inch (3 mm):
   - Loosen and turn blade on spindle approximately 90 degrees—recheck.
   - If difference does not change, blade is not flat—replace
   - If it changes, spindle is bent—replace
4. If the difference between A and B is less than 1/8 inch (3 mm) go to step 5.



5. Compare tips C and D of second blade to tip B of first blade. If the difference between C and D is greater than 1/8 inch (3 mm):
   - Loosen and turn blade on spindle approximately 90 degrees—recheck.
   - If difference does not change, blade is not flat—replace
   - If it changes, spindle is bent—replace
6. If the difference between C and D is less than 1/8 inch (3 mm):
   - If the blade and spindle are acceptable, the deck may be warped or spindle pocket bent. Place a straight edge across blade from one blade cap screw to the other. Measure from straight edge to blade tips to determine which spindle pocket is off. Install a shim (washer) on the appropriate spindle side, under 2 of the 4 spindle housing cap screws to bring blade back to level.

BLADE DRIVE BELT REMOVAL/ INSTALLATION—STX30

1. Remove ignition key and disconnect spark plug wire.
2. Lower mower.

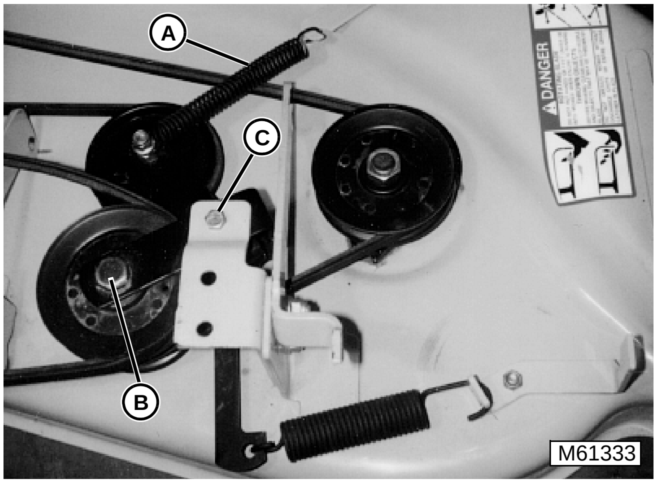


3. Put belt tension lever (A) in disengage position.
4. Remove belt from PTO clutch and mower deck sheaves.
5. Reverse procedure for installation. No belt adjustment is necessary.

BLADE-TO-BLADE BELT REMOVAL/INSTALLATION STX38 (SN —210000)

Removal

1. Remove ignition key and disconnect spark plug wire.
2. Lower mower.



⚠ CAUTION

Wear eye protection when disconnecting and connecting spring (A).

3. Disconnect spring (A).
4. Remove cap screw (B) and sheave. Some models require idler (C) to be removed also.
5. Remove belt.

Installation

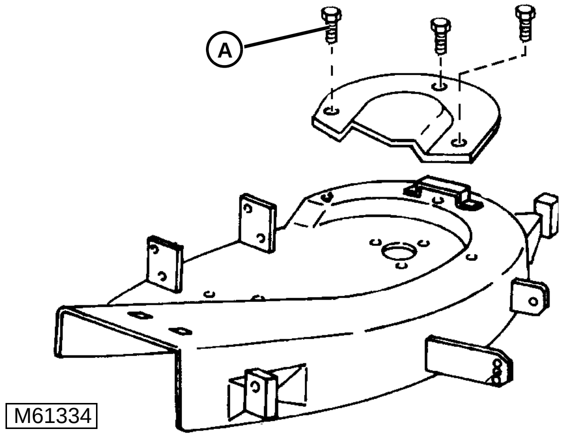
6. Install sheave and belt.
7. Tighten cap screw (B) to specification.
8. Connect spring (A).

Specification

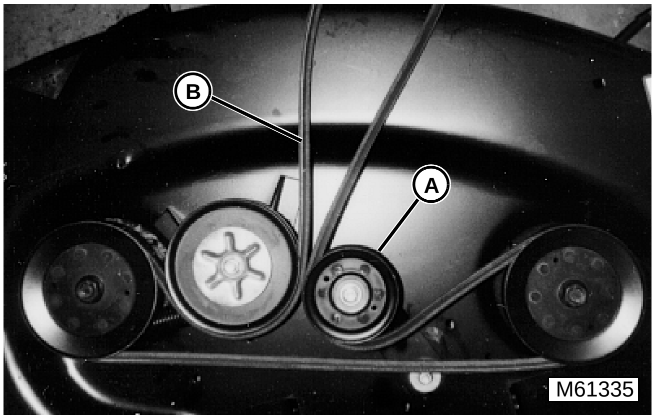
Cap Screw. .95 N•m (70 lb-ft)

BELT REMOVAL/INSTALLATION STX38 (SN 210001—) STX46 (SN 240001—)

1. Remove ignition key and disconnect spark plug wire.
2. Lower mower.



3. Remove cap screws and shield (A).

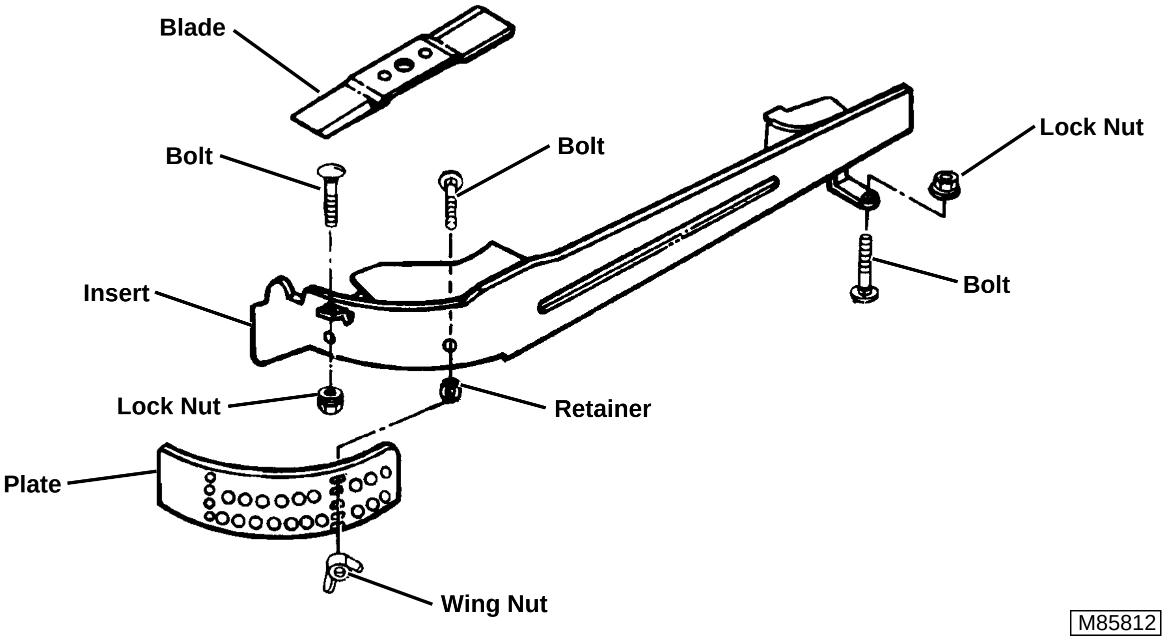


⚠ CAUTION

Wear eye protection when disconnecting and connecting spring (A).

4. Apply tension on idler (A).
5. Remove belt (B).
6. Install belt (B). Carefully thread belt around and thru sheaves and idler (A).
7. Install shield and cap screws.

MOWER DECK BLOWOUT—STX46



NOTE: Blowout reduction kit (AM124031) is used to provide sufficient lip surface around deck to install conventional blowout reduction kit like on 48/54” decks.

Reason:

Grass blows out front of deck. Seems worse when mulch kit has been installed.

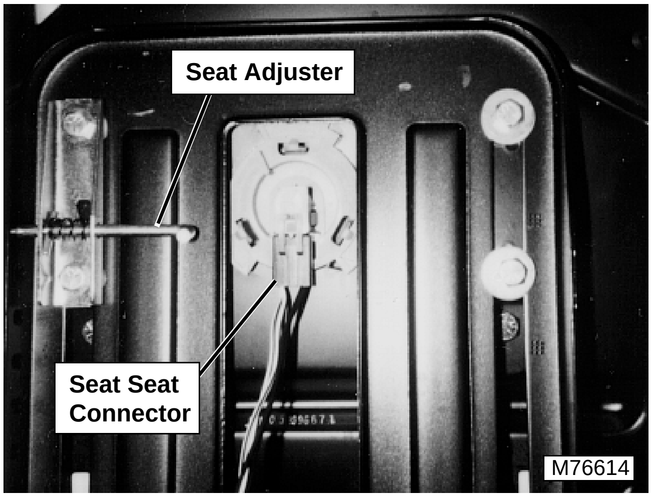
Procedure:

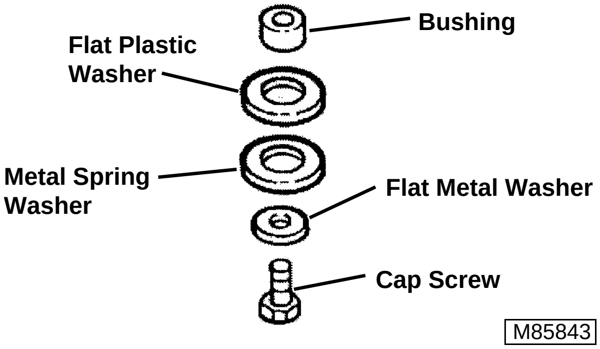
1. If deck is equipped with a mulch kit, start with adjustable screen fully raised. This will allow more airflow out discharge chute.
2. Level the mower front-to-rear as instructed in machine operators manual.
3. If mulching leaves, lower adjustable screen only as much as needed for satisfactory mulching.
4. Other items to check:
   —Engine fast idle speed set to specification.
   —Blades sharp and underside of deck clean.
   —Be sure ground speed is not too fast for mowing conditions.
   —Observe the 1/3rd cut rule.
   —Be sure deck is properly leveled side-to-side.
   —Review information on mulching tips.

SEAT REMOVAL & INSTALLATION

MOUNTING PLATE

Removal





1. Lift operator’s seat forward to allow access to adjuster hardware.
2. Disconnect seat switch electrical connector.
3. Remove four cap screws holding seat and seat adjuster to mounting plate.
4. Remove seat adjuster and seat from mounting bracket.

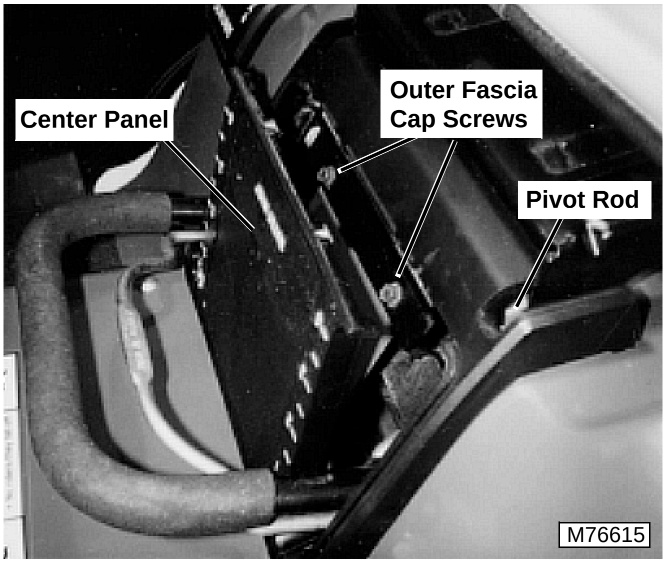
IMPORTANT: If replacing seat knob make sure seat knob threads are clean to prevent breaking the knob. Remove Loctite® with wire brush, wheel or heat the Loctite® before installing. If pliers are required to install, come down over the top of the knob to grip it. Gripping the knob from the side will probably break the plastic.

Installation:

1. Align holes in seat bottom with slots in mounting plate. Align adjuster with slots and install cap screws and washers in order as shown above.
2. Connect seat switch electrical connector.

MOWER FRAME

Removal



Seat mounting plate may be removed with seat attached as follows:

1. Using a small screwdriver, pry center panel from outer frame using small square holes provided. Remove center panel.
2. Remove two cap screws at top of outer frame. Pry two plastic retainers at bottom of outer frame from holes in mower frame. Remove outer frame from mower by pulling out over mower deck lift handle.
3. Disconnect seat switch electrical connector.
4. Remove seat mounting plate pivot rod from mower frame. Remove seat and seat mounting plate from mower.

Installation:

1. Install the seat mounting plate by lining up holes in frame and sliding pivot rod through holes.
2. Install fascia outer frame over mower deck lift handle and snap lover plastic retainers into holes in mower frame.
3. Install two cap screws into top fascia and into mower frame.
4. Install center panel into outer frame of fascia by inserting bottom tabs of center panel into slots at bottom of outer frame. Snap top of center panel into slots on top outer frame.

NOTE: The seat switch connector has an interlock spring which shorts the 3 wires together when it is removed from the seat switch terminals.

5. Connect seat switch electrical connector.

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